Volume 72, No. 1
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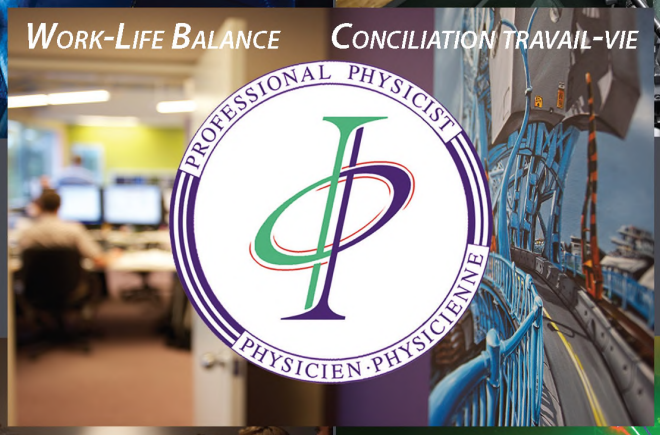
Physics in Canada
La Physique au Canada

Perspectives de carrières Career Opportunities



Professional Development

Compétence

Intérêt public

Safety

Professionalism in Physics

Le professionnalisme en physique

Canadian Association of Physicists / Association canadienne des physiciens et physiciennes

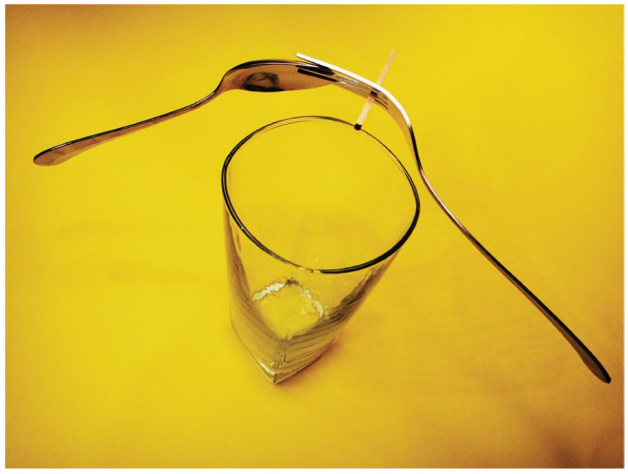
www.cap.ca

Join the Fun
Joignez l'amusement

Art of Physics Competition

You are invited to enter the competition (open or high school categories) by capturing in a photograph a beautiful or unusual physics phenomenon and explaining it in less than 200 words in terms that everyone can understand.

The emphasis of this contest is not so much on having a high level of physics comprehension as it is on being able to explain the general principle behind the photograph submitted. Individual (open and high school) and high school class entries are invited up until April 15 each year (see http://www.cap.ca/en/activities/art-physics for entry form and rules). Please note that all entries must be original artwork produced by the participant.



Tout est dans le centre de la masse.

2e place (Projets scolaires au secondaire ou cégep) - compétition 2015

par Amélie Drouin,
Cité-des-Jeunes, Vaudreuil-Dorion, QC
(see http://www.cap.ca/aop/aop/2015-tout-masse.html)

Winning entries will form part of our Art of Physics exhibition which may be on display at the Canada Science and Technology Museum, and may appear as a cover on our publication, *Physics in Canada*. They will also be posted on our Art of Physics website at http://www.cap.ca.

We hope you will take advantage of this opportunity to explore the art of physics by submitting entries for the next competition.

Concours l'Art de la physique

Vous êtes invités (es) à participer (aux catégories ouverte ou école secondaire) en photographiant un phénomène physique magnifique, ou particulier, et en rédigeant un court texte explicatif de moins de 200 mots, en termes simples et à la portée de tous.

L'accent de ce concours est de pouvoir expliquer le principe général de la photo soumise plutôt que de démontrer un niveau élevé de compréhension de la physique. L'échéance pour les inscriptions individuelles ouvert et école secondaire) et scolaires (voir formulaire d'inscription/règlements à http://www.cap.ca/fr/activites/lart-de-physique) est fixée au 15 avril chaque année. Notez bien que toutes les inscriptions doivent être des oeuvres originales du participant ou de la participante.

Les soumissions gagnantes feront partie de notre exposition L'Art de la physique au Musée des sciences et de la technologie du Canada et auront une chance de paraître sur la couverture d'un numéro de *La Physique au Canada*. Elles seront également affichées sous la rubrique L'Art de la physique du site web de l'ACP à l'adresse suivante: http://www.cap.ca.

Nous espérons que vous profiterez de cette occasion d'explorer l'art de la physique en soumettant une oeuvre pour la prochaine compétition.

Physics in Canada
La Physique au Canada

Volume 72 No. 1 (2016)

Canadian Association of Physicists
Association canadienne des physiciens et physiciennes
www.cap.ca

Cover / Couverture :

Every physics graduate will need to apply aspects of professionalism throughout their career. Obtaining a professional certification demonstrates their awareness of, and commitment to, these principles. The Space and Dimensions image by David Jian Kun Zhu (top left) as well as the Laser Diffractions image by Blago Hristovski (bottom right) are winning entries from the CAP's Art of Physics competition (see www.cap.ca/aop/art.html for image descriptions). The remaining images were provided by Starfish Medical, Vancouver BC.

Les diplômés en physique devront exercer des aspects de professionnalisme tout au long de leur carrière. Obtenir une certification professionnelle démontre qu'ils sont au courant de ces principes et s'engagent à les respecter. Les photos en haut à gauche et en bas à droite sont des soumissions gagnantes le la compétition Art de la physique (voir www.cap.ca/aop/art.html); respectivement « Space and Dimensions » de David Jian Kun Zhu et " Laser Diffractions " de Blago Hristovski. Les autres photos ont été fournies par Starfish Medical, Vancouver C.B.

DEPARTMENTS
DÉPARTEMENTS

Canadian Association of Physicists (CAP)
Association canadienne des physiciens et physiciennes (ACP)

The Canadian Association of Physicists was founded in 1945 as a non-profit association representing the interests of Canadian physicists. The CAP is a broadly-based national network of physicists in working in Canadian educational, industrial, and research settings. We are a strong and effective advocacy group for support of, and excellence in, physics research and education. We represent the voice of Canadian physicists to government, granting agencies, and many international scientific societies. We are an enthusiastic sponsor of events and activities promoting Canadian physics and physicists, including the CAP's annual congress and national physics journal. We are proud to offer and continually enhance our web site as a key resource for individuals pursuing careers in physics and physics education. Details of the many activities of the Association can be found at http://www.cap.ca. Membership application forms are also available in the membership section of that website.

L'Association canadienne des physiciens et physiciennes a été fondée en 1946 comme une association à but non-lucratif représentant les intérêts des physicien(ne)s canadien(ne)s. L'ACP est un vaste regroupement de physiciens oeuvrant dans les milieux canadiens de l'éducation, de l'industrie et de la recherche. Nous constituons un groupe de pression solide et efficace, ayant pour objectif le soutien de la recherche et de l'éducation en physique, et leur excellence. Nous sommes le porte-parole des physiciens canadiens face au gouvernement, aux organismes subventionnaires et à plusieurs sociétés scientifiques internationales. Nous nous faisons le promoteur enthousiaste d'événements et d'activités mettant à l'avant-scène la physique et les physiciens canadiens, en particulier le congrès annuel et la revue de l'Association. Nous sommes fiers d'offrir et de développer continuellement notre site Web pour en faire une ressource clé pour ceux qui poursuivent leur carrière en physique et dans l'enseignement de la physique. Vous pouvez trouver les renseignements concernant les nombreuses activités de l'ACP à http://www.cap.ca. Les formulaires d'adhésion sont aussi disponibles dans la rubrique «Adhésion» sur ce site.

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PROFESSIONALISM IN PHYSICS

The CAP initiated a professional certification process in 1997, with a view towards providing a professional designation for Canadian physicists. Currently, over 200 CAP members are certified as P.Phys.

One of the strategic initiatives currently in progress within the CAP is to promote the Professional Physicist (P.Phys.) designation, and to increase the numbers of physicists in Canada who use the P.Phys. designation.

To this end, this issue of *Physics in Canada* is focussing on the topic of professionalism in physics. A group of authors, drawn from a wide cross-section of physicists, have been recruited to discuss this topic in relation to their professional experience which include:

- Entrepreneurship (Brown), where a successful physicist explains how entrepreneurship can be used to build a career in physics
- Undergraduate teaching (Hawkes), explaining how educators can prepare students for productive careers after graduation with an undergraduate physics degree
- The perspective of a recent physics graduate (Laroche), who outlines a student's view (mostly positive) on how to build a career with an undergraduate degree in physics
- The role of professional designations in physics careers (Pathak, Tun)
- A discussion of issues related to scientific publishing (Steinitz)
- Physics in product development (Walmsley), where a senior physicist from industry outlines the challenges working in this sector

We hope that you will enjoy reading about their experiences as well as their perspectives on professionalism in physics.

Mick Lord, B.Sc., Dipl.Meteo., P.Phys.
Mike O'Neill, M.Sc., P.Eng., P.Phys.
Guest Editors, *Physics in Canada*

Comments of readers on this foreword are more than welcome.

LE PROFESSIONNALISME EN PHYSIQUE

L'ACP a amorcé en 1997 un processus de certification professionnelle dans le but de fournir une désignation professionnelle aux physiciennes et physiciens canadiens. Actuellement, plus de 200 de ses membres détiennent la certification phys.

L'une des initiatives stratégiques entreprises actuellement par l'ACP vise à promouvoir la désignation de physicien (phys.) et à augmenter le nombre de physiciens qui utilisent cette désignation au Canada.

À cette fin, le présent numéro de *La Physique au Canada* traite du sujet du professionnalisme en physique. Un groupe d'auteurs, représentant un large courant d'opinion de physiciens, a été formé afin d'examiner ce sujet relativement à l'expérience professionnelle de chacun, à savoir :

- L'entrepreneuriat (Brown), amène un physicien qui réussit à dire comment l'entrepreneuriat peut servir à bâtir une carrière en physique
- L'enseignement au niveau du baccalauréat (Hawkes), explique comment l'enseignant peut préparer les

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and

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étudiants à des carrières productives après qu'ils ont obtenu un diplôme de 1er cycle en physique
- Les perspectives d'un diplômé en physique de fraîche date (Laroche), expose le point de vue (surtout positif) d'un étudiant sur la façon de bâtir une carrière avec un diplôme de 1er cycle en physique
- Le rôle des désignations professionnelles dans les carrières en physique (Pathak, Tun)
- Une discussion sur les questions relatives à l'édition scientifique (Steinitz)
- La physique dans la conception de produits (Walmsley), ce qui amène un physicien principal de l'industrie à énoncer les défis qui se posent à ceux qui travaillent dans ce secteur

Nous espérons que vous aimerez lire ces articles qui portent sur leurs expériences et perspectives sur le professionnalisme en physique.

Mick Lord, B.Sc., Dipl.Meteo., phys.
Mike O'Neill, M.Sc., P.Eng., phys.
Rédacteurs invités

Les commentaires de nos lecteurs ou lectrices au sujet de cette préface sont bienvenus.

NOTE: Le genre masculin n'a été utilisé que pour alléger le texte.

Physics as a self-regulating profession – positioning the P.Phys. to make this possible

Over the years I have plied my physics training in a number of fields, including the military, industry, clinical health care, academia and management, becoming a certified medical physicist in South Africa some 30+ years ago and obtaining my P.Phys. certification in Canada in 2002. I have served on the boards of the Canadian Association of Physicists (CAP) and the Canadian Organization of Medical Physicists (COMP) at times when issues related to professional certification and its management have been of concern.

The various articles that appear in this issue of *Physics in Canada* on Professionalism will provide you with a broad introduction to Professionalism. You will learn about some of the designations offered by different professional societies across the world and how such a certification may benefit the holder, how professional regulation is often put in place to protect the "client," how a degree in physics can open many career opportunities and how important ethics, teamwork and communication is to the professional physicist.

Read in isolation, however, you may also be left with the impression that the world of professional regulation is well defined, clean and orderly. Unfortunately establishing and managing such professional designations is not a simple process. Even the definition of a "profession" is not easy to tie down, particularly if you dare to venture beyond the bland Wikipedia definition of "a vocation founded upon specialised educational training, the purpose of which is to supply disinterested objective counsel and service to others, for a direct and definite compensation, wholly apart from expectation of other business gain." [1]

In 1980 A.L. Barlow wrote [2], in a review of "The Rise of professionalism: a sociological analysis," by Magali Sarfatti Larson [3], that "professionalism has come to mean, simultaneously, everything and nothing," with the ideals of a self-regulating profession designed to protect the clients or public often giving way to "a means of controlling an occupation". Initially, the characteristics of a self-regulating profession were the mastery of knowledge and a capacity to solve theoretical and practical problems, a commitment to duty above self-interest or personal gain, and independence from external interference in the affairs of the profession (self-government). Later, these key characteristics began to be overshadowed by the perceived prestige of the self-regulated profession and the market advantage of the exclusive use of a professional title and right to practice. Not surprisingly, professions lobbying for self-regulating status now often do so with mixed motives [4].

The courts seem to be concluding that the rationale for creating a self-regulating profession is the protection of the public and a key criterion for statutory regulation of a profession is whether such self-regulation is in the public interest[1]; i.e., will it serve to protect the public against incompetence and misconduct that could affect the life, health, welfare, safety or property of the public. Recently, Robert Mysicka from the pro-business, C.D. Howe Institute, found that, for certain self-governing professions, the public interest is not being adequately protected [5]. He has argued that laws that grant statutory powers to a profession must be carefully drafted and scrutinised to ensure that the public interest is adequately protected and that a regulatory system that delegates powers to self-regulated bodies must ensure that competition remains effective in a transparent and dynamic marketplace.

Where does the CAP's professional physicists designation P.Phys. fit within this environment? Professional Physicists do not have statutory protection like the Professional Engineers and Lawyers do, nor is the Government likely to grant such regulation given the rationale noted above. The discussions that led to the establishment of this designation were more focused on how we can attract students to the field and demonstrate the relevance of a physics training to potential employers. Perhaps we can argue that we are less concerned with controlling entry

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1. Justice Iacobucci concluded that: "On this view, the self- governing status of the professions, and of the legal profession in particular, was created in the public interest." Quoted in: Devlin, Richard and Heffernan, Porter, The End(s) of Self Regulation? (November 9, 2007). Alberta Law Review, Vol. 45, No. 5, 2008. Available at SSRN: http://ssrn.com/abstract=2101801.

into the field of physics and thus are more closely aligned with the fundamental ideals of a self-regulating profession. We have a Code of Ethics and an expectation that P.Phys. holders are competent and ethical and that they will ensure that they maintain their scientific competence and their knowledge of the ethical and legal practices required of a professional. For this to be reliable, we need a well defined and transparent mechanism to identify and discipline those P.Phys. holders who do not live up to these standards. Herein lies a potential conflict of interest, because the objectives of a professional society such as the CAP, which provides services and advocacy for its members, could at times be at odds with the goals of a self-regulated profession which should have as its primary objective the protection of the client or public. That is why the regulatory arm of many professions is distinct from, or at a minimum operates at arm's length from, the advocacy body.

While the P.Phys. holder is expected to abide by a Code of Ethics, it is not very detailed and most professional organisations have a much more extensive Code of Practice defining (often with examples) what the regulated professional can and, more importantly, cannot do. I would argue that a more detailed Code of Practice would be helpful to all practicing physicists, but particularly for those of us who work with or in Industry. These rules of conduct should assist, not hinder, professional physicists in providing physics services to their clients (which may include students and colleagues in academia) in a way that ensures the clients and public interest is protected. It is important to note that these codes of conduct should not prevent a P.Phys. holder from making sound business decisions on behalf of their employer or company, even if those decisions are not universally welcomed by the employees or physicists whom they affect. While the lack of statutory regulation may be seen as a limitation to the expansion of the P.Phys. certification, there are good examples of professions where employers have come to recognise (without this being a legislated requirement) the value of hiring self-regulated professionals.

The CAP P.Phys. process is well managed by the CAP's Director of Professional Affairs aided by the dedicated members of the Professional Affairs Committee and the Professional Certification Committee. However, more work still needs to be done as the P.Phys. matures and hopefully expands. This could include the removal of the exemption to writing the professional practice exam and a more robust method for evaluating continuing professional development. All physicists, irrespective of the field or institution in which they practice, should identify with the goals of the P.Phys. program, which at its root is aimed at strengthening the role of physics and physicists in our society by ensuring that our actions are not detrimental to that society. I would advocate that every CAP member should apply for a P.Phys. designation, and demonstrate through a high standard of practice, professionalism and by continuous professional development that the ideals of a self-regulating profession are alive and well in the Canadian physics community.

SUGGESTED ADDITIONAL READING

Paton, Paul D., Between a Rock and a Hard Place: The Future of Self-Regulation - Canada between the United States and the English/Australian Experience (August 14, 2008). The Professional Lawyer, Fall 2008. Available at SSRN: http://ssrn.com/abstract=1226802.

ACKNOWLEDGEMENTS

I would like to thank Francine Ford, Mick Lord and Mike O'Neill for their valuable input and suggestions that helped me craft this opinion.

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1. https://en.wikipedia.org/wiki/Profession.
2. A.L. Barlow review of Ref. [3], *Harvard Educational Review*, **50(3)**, 427–432 (1980).
3. Larson, M.S., *The Rise of professionalism: a sociological analysis*, Berkeley, University of California Press, 1977.
4. Schultze R., *The Canadian Property Valuation*, **56(3)**, 26–29 (2012).
5. *Who Watches the Watchmen? The Role of the Self-Regulator*, C.D. Howe Institute, Commentary No 416, October 2014, Toronto.

THE ENTREPRENEURIAL PHYSICIST

BY LOIS BROWN, RTR (CAN/USA), ACR, MSc., P.PHYS.

When I was very young I collected wildflowers at our summer cottage. I then went around to various family members and invited them to pay to have a peek at my floral arrangements. I had mixed responses depending on the attitude of the people I approached.

I did learn some very valuable lessons during that exercise which have stood me in good stead over the span of a lifetime in sales and consulting.

I was fortunate in that I had a talent for selling and have done so in various capacities throughout my fifty-year career in the Radiation Sciences. The following points are what I have developed as my Fourteen Commandments that are vital to any sales, whether you are selling knowledge or products. To succeed and thrive, your business acumen must be based on these foundations.

1. Be Open and Transparent with Employers, Clients and Customers. Before any change in your career path, make sure you have covered all the bases with your present employer or with anyone else with whom you have business dealings of any sort. You must be open and transparent. In other words, don't give up your day job for the enticement of a lucrative but short-lived contract.

It is best to have a hard copy of your present contract so that if any discussion arises you have proof that this was discussed and cleared before any dissension arises.

2. Be Scrupulously Honest. Always. It is a small world and often separated by very few degrees. Your reputation as a consultant will be compromised if you are perceived as being even slightly ambiguous.

3. Be Very Reliable. If you have an appointment and have set a time, then plan to arrive at least 10 minutes early. This is vitally important. If you are held up in traffic or by unforeseen circumstances, then call in at least ten minutes prior to your expected time of arrival. I do this even if I am going to be a few minutes late. Your client will (presumably) be ready and waiting and it is only fair to let them know.

SUMMARY

In this article, the lessons learned from a lifetime of working as a physicist and an entrepreneur are discussed.

4. Communicate with All Parties. Ensure that everyone is in the loop at all times; talk with everyone in the area. A large hospital hired me to ascertain why the readings on the personnel radiation dosimeters had suddenly escalated. It was only through a chance discussion with the department housekeeping personnel that I discovered the solution to the problem.

5. Respect your competition. Remember they are as determined to make a success of their business as you are and they have to buy groceries too. If you get the contract, analyze what you did correctly. If you didn't win the contract, learn from the experience and identify what you could have done differently.

6. Don't sell yourself short. It should not cost you money to achieve a contract. When you are bidding on a contract there may be another physicist or company bidding as well. Make sure you have priced your quotation fairly, allowing yourself some "wiggle room" and then hold to your price.

7. When you are initiating a contact, your "sales pitch" should always include the added benefit of your expertise. Someone else may cost less but may not offer all the credentials that you can offer at the end of the report.

8. Call in a colleague with different skills if you find the job takes you beyond your area of expertise. Sometimes you may need a machinist or an engineer. Over many years you will build up a list of reliable associates who have expertise in many areas and who are willing to work with you provided you acknowledge them in your final report and even pay them for their assistance if that is appropriate.

9. Be creative. Think outside the box. Find a solution to the problem that may be unusual or unique. A situation arose at a veterinary clinic where the installation of the dental x-ray unit was in question. There was simply nowhere to put the arm of the unit until we decided to hang it from the ceiling. With the help of the installation engineer and some creative wiring, we made it work.

Lois Brown,
President, Xray Imaging Consultants Ltd., 97 Tecumseth Pines Drive,
Tottenham,
ON L0G 1W0

10. Keep the main objective in mind. If you are called in to a very messy situation, remember that there are always unscrupulous people in any field. Do not criticize your competition, ever. You are there to solve a problem. . . or several problems. Also, you are there to alleviate the stress caused by someone's bad decision in the first place. Any negative comments are just not appropriate.

11. Speak to your client at their level of understanding/ expertise. If the work you are doing requires a fairly high level of expertise, break it down into language that your client will understand. Sometimes this is difficult but analogies, no matter how farfetched, will help immensely.

12. Always make the resolution of the situation practical. To the client, staff and the vendor you are the content expert. Always move forward to a positive resolution. If the person you are given to work with is clearly out of their depth, then quietly move to the next level in the account's hierarchy. Everyone will thank you later.

13. Sometimes there is no positive solution other than replacing the faulty equipment and starting again. Communicate as you are progressing through your research of the problem. Present your report and make yourself available to back up your findings to whomever contacts you.

14. Charge fair prices. Yes, you have worked hard to arrive at a position of expertise and the cost of that education must be factored into your quotation. Remember that with budget limits to meet, your potential clients may be forced to accept a less expensive quote just because you have priced yourself out of the marketplace. Repeat business will only come if the clients feel that they are receiving fair value for the money they pay.

Finally, one must be adaptable and open minded when faced with unusual problems. As a radiography consultant, I was called in to a veterinary hospital to identify some unusual artifacts that had shown up on the client's film images over the previous month.

When I arrived, the veterinarian was distressed as she had just locked herself out of the hospital. We were miles out in the country so there was nothing to do but climb in through a window. I was the slimmest and youngest of the three of us, so with the help of a milk crate I slid through the window.

The film images were presented and they consisted of irregular light and dark densities overlain by curious small dark pinpoints in groups of four. Some of these pinpoints were elongated to about 2 centimeters. The black pinpoints were located in random order over the images as were the irregular light and dark densities.

After exploring all the usual areas to ensure that the film cassettes and unused film were not being fogged, I turned to the darkroom. This turned out to double as the furnace room. The solution to the problem became clear when I looked at the main furnace duct exiting the furnace. The box of film in use at the time was stored on top of the furnace duct. This only became a problem when the furnace was turned on in October and the intermittent irregularities reflected uneven increases in base fog on the film as the furnace heated the duct.

The pinpoint artifacts? They were made by the clinic cat who found the duct was a little warm so he was lying on the box of film and, as cats will do, stretching and flexing his claws through the box of film and its protective covering creating the pinpoint artifacts with the slight elongations.

Lessons learned? The solution will always be unique to the specific account. The consulting itself may take some unexpected turns which require you to be both flexible and adaptable, such as climbing through a window to arrive at the source of the problem. The resolution to the problem may very much depend on the attendance of the consultant at the account rather than just a review of images on the computer and a telephone call.

There is definitely much satisfaction in consulting with clients and solving challenging and unique problems. Also, if you are so inclined you are setting yourself up to becoming a valuable asset after you retire from your day job.

PREPARING UNDERGRADUATE STUDENTS FOR A CAREER AS A PROFESSIONAL PHYSICIST

BY ROBERT LEWIS HAWKES, P.PHYS.

One of the seven principles for upper level physics courses [1] is using course activities that model professional practice. In this article we develop that idea into a set of practical methods that can be incorporated into the undergraduate curriculum.

PHYSICS IS MORE THAN PHYSICS

Too often we stop at the physics principles, rather than go on to consider social, ethical, economic or public policy aspects surrounding that physics. As a professional physicist, you are not divorced from aspects that go beyond physics. For example research proposals often consider impact on a wider community, and industrial physics work almost always must include economic as well as physical or engineering considerations. Class activities and assigned work should similarly ask students to work within a broader context. In teaching an energy course a few years ago I found that class activities that integrated physics principles with economic factors motivated high student engagement. It is highly relevant that one of the five bullets under the experience component in the P.Phys. certification requirements is "understanding the social implications of physics," [2] and that should start in our undergraduate courses.

MAKING IT REALISTIC AND WORTHWHILE

Too often, students perceive the 'work' they are given as "class work", with no relevance to the working world. This starts with first year problems that are closed with a single precise answer and with all relevant input parameters isolated. We all know that the real world of a professional physicist is much more like a series of Fermi problems [3], with the need to make reasonable approximations and to evaluate what information is relevant.

SUMMARY

This article describes ways to prepare undergraduate students for transition into a career as a professional physicist.

Students value more highly work that they regard as meaningful. While service learning and co-operative programs naturally contribute to this, there are ways that you can build these components into any class. For example, consider making class presentations open to a wider audience. When possible, have students work on problems that are genuine. These can either be locally relevant questions emerging from one of your department's research labs, or a broader Fermi question such as what are the risk and environmental consequences of an asteroid impact. These real world problems challenge students to evaluate and apply a broad array of physics principles, along with requiring that they determine what is relevant and seek a myriad of sources of reliable input information. Why not consider making some of your lab experiences tackle a real local issue? Many physics classes now use video analysis of motion as part of lab experiences. Why not collaborate with an athletic group to use physics skills to provide guidance for improved performance?

WORKING EFFECTIVELY WITH OTHERS

In most future career paths, physics graduates need to be able to work effectively with supervisors, peers and potentially others. There is strong evidence that collaborative learning in physics classrooms is an effective way to learn physics [4] but the good collaboration skills that result are an important additional benefit. Effective student teams don't just happen and you should give thought to how you can assist teams be productive and positive [5]. Your department may want to consider an integrated approach to building collaboration skills, starting perhaps with peer learning or studio-style collaborative groups in first year and progressing to challenging open-ended team projects in the upper years. An interesting question is whether teamwork in physics should be restricted to physics students or if it is feasible to have teams across courses beyond the physics department – for example have students in physics and economics work together on an industrial physics proposal, or have students in physics and public policy tackle a question such as the medical isotope shortage or the future of nuclear power in Canada.

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FINDING CHALLENGE AND OPPORTUNITY

Professional physicists thrive on challenge and to be successful must seek opportunities. We should not be afraid to truly challenge our students and to give them ownership in the task of finding innovative ways to apply their physics skills. While genuine undergraduate research experiences are the most obvious way to meet these aims, research experiences are not the only way. Have you considered having your class work collectively to create an electronic textbook tailored specifically to your course, with each student having a clear role (both in writing and reviewing)? Alternatively, could your class together create a quality media production on some physics topic intended for a broader audience? It is unfortunate that case studies are not more widely used in physics learning. There are a number of physics-themed case studies in the National Center for Case Study Teaching in Science [6]. Why not consider having your students develop case studies that can be shared with other physics educators? Case studies are ideal for professional physicist preparation, since they naturally combine physics principles with social, ethical and economic aspects.

COMMUNICATING TO DIFFERENT AUDIENCES

Many undergraduate physics courses, particularly at the upper levels, incorporate elements of scientific communication. These may be in written form, such as lab reports, simulated grant applications, essays, poster papers or scientific papers, or as oral presentations within class or to a wider audience. I would like to stress two main points: the first is to give consideration to the audience, and the second is to encourage students to 'speak' to different types of audiences. Communication will be more highly valued if there is a genuine audience, one that is beyond the instructor and other class members. Engage your students in the early planning of a course communication component, and be flexible and open to their suggestions in this regard. Students can write for publications, create and post YouTube videos, produce a series of Twitter posts, maintain a public blog, speak to local media, etc. As physicists, it is perhaps natural that we seek, and more highly value, opportunities to speak to other physicists. I feel that we miss many opportunities when we limit ourselves in this way. The life of a professional physicist requires regular and effective communication with those lacking physics expertise, and we should start such communication during the undergraduate years. Think broadly - e.g. could students write a children's book on the advanced physics in your course, or conduct a related workshop at your local science centre or children's museum? Does your course content relate to a current public policy issue, and if so could you have students prepare position papers and then present them to politicians and community leaders?

ETHICS AND RESPONSIBILITY

Ethics and responsibility play major roles in the P.Phys. [7], yet infrequently are these topics explicitly addressed in undergraduate physics courses. A few years ago we ran a science research program for highly motivated high school students [8], and as one component of that we initiated evening discussions on social and ethical aspects of science. The topics were widely varied, everything from scientific fraud, to reviewer responsibilities, to the perception of scientists in the media. These high school students enthusiastically and eloquently debated issues, and expressed the regret that they had not been similarly engaged during their formal science education. Our physics classrooms should not artificially divide the implications of physics from the physics concepts. While our primary goal, of course, is to teach physics concepts, spending a small amount of time to place these scientific ideas within a context helps to prepare students for life as a professional physicist as well as a more fully rounded scientist.

BECOMING PART OF A PHYSICS COMMUNITY

As a professional physicist, you are part of various professional communities: professional groups such as the Canadian Association of Physicists (CAP), national and international research collaborations, and your own research and development group. You should provide opportunities for students to begin to feel part of a physics community beyond your class and university. Regional or national undergraduate conferences, such as the Canadian Undergraduate Physics Conference, are an obvious first step, followed by attending and presenting at the annual CAP Congress or at other professional workshops and conferences. Having students meaningfully interact with visiting scientists is another way for them to begin to build their physics community. While being considerate of demands on their time, consider fostering electronic communication between national and international research collaborators and students in your research group or upper level classes.

Social media provide a valuable way for physicists to stay connected with a broader community. Sites like ResearchGate provides an avenue for professional discussion, as well as a resource of published literature. LinkedIn is a valuable tool for young physicists seeking future employment possibilities. A number of departments use a LinkedIn group for graduates and current students to connect with each other. Twitter can be a powerful means of interacting with a 'community' that is not limited geographically or in terms of expertise. While Twitter has become heavily used in some disciplines (e.g. astronomy and planetary science) it seems much less universally used thus far in most areas of physics. If you are not on Twitter, I urge you to set up an account and give it a try for a month or so. Meaghan Duffy has written a good account on why she uses Twitter [9]. Although she is not a physicist, all of her ideas transfer to physicists: keep up with literature, conferences, technical help, live-tweeting of talks or events, finding examples for teaching, learning to be concise, and connecting to science writers. I would add to that list that Twitter helps you connect with those who work in science policy. If you find

Twitter valuable personally, consider urging your students to use Twitter within the context of your class. Many of the themes explored in this article, such as seeking opportunity, speaking to diverse audiences, forming a wide community and meaningful engagement, can be well supported by Twitter.

CONCLUDING REMARKS

You should not see helping students prepare for the transition to a professional physicist as something you must do in addition to your teaching. Many of the ideas expressed here, making content relevant, applied, interdisciplinary and meaningful, and requiring collaboration and communication as part of the learning process, are core to effective learning. Indeed, the CAP Division of Physics Education revitalization document [10] draws on many of the same themes. We urge all instructors to explicitly consider career-related transition as one facet of instructional planning. Great advice for students and instructors can be found in this Canadian publication [11]. In their report "Why many undergraduate physics programs are good but few are great" [12] many of the features of great physics programs described in the article contribute to a climate encouraging transition to the life of a professional physicist.

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WHAT CAN I DO WITH A B.SC. IN PHYSICS?

BY JOSH LAROCHE

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SUMMARY

A recent graduate in physics relates his experiences in developing a career.

These are words I admittedly searched on Google during my first years in the Concordia undergraduate physics program. For me, getting a degree in physics was nothing like the experiences my friends had in the engineering, computer science or accounting programs, where you end up working in a pre-defined sector. There is no clear path set out in front of you, no special "job" awaiting you on the other side of that diploma and hand-shake, and if you ask around it seems nobody has a really firm answer for what physics students should look forward to upon graduation. I'll never forget this one response in particular *"A bachelor's in physics is fantastic... as long as you pair it with something else..."* – Wait, what?! Let me explain...

Now, that's not to say you need a second degree or to immediately go for a Master's or PhD in order to be employable, like I assumed it would as I began my third-year course load – well beyond the point of no return. I can now say, as I look back on the past three years of my career after graduating, that I finally understand what it really means. You see, physics degrees have a uniquely intrinsic value not common among other degrees, and how that value comes to fruition is all in how you "spin" it. So many school programs are focused on *"teaching kids what they need to know to get jobs"* while I feel the physics program taught me about solving the world's most complex and abstract problems and finding creative solutions, managing high workloads and learning to work in a team to solve really difficult problems. These are real skills which have been of direct benefit to me. Physics is a naturally inquisitive subject, where we are constantly asking questions about our surroundings, and just like the path to scientific discovery, we are always trying to leverage what is currently known to gain something further.

During my time at Concordia I had many side projects, and for me, music and physics have always been a passion; I played guitar in a band for many years, we played all the local clubs and toured across the country to the West Coast in 2009. I was also running a small concert promotions company booking a few shows a month to make some cash, along with working night-shift at a security job on the weekends and grading papers and assisting in research at the Concordia Physics Lab during the week. (They have a great co-op program and some very kind professors doing some very interesting research.)

When I graduated, I incorporated my concert promo business and made the transition from a local concert promoter to a booking agency, signed a couple of international DJ's and artists and started setting up shows and tours all across the country, operating under the name of SkyRocket Entertainment Agency[1]) which today, 4 years later, is now merging with the Internationally renowned Convoy Artist Agency[2]. I've always been very passionate about working with my hands too – which is why I thought the Physics Labs were such a valuable experience; while in school I imported a right-hand drive 1992 Nissan Skyline GTR from Japan and over the course of a few years became a self-taught mechanic, totally rebuilding the car from the ground up, replacing vital engine components, upgrading the turbo-chargers and tuning the ECU for the car on a dynamometer to over 400 horse power. In doing so I documented every step along the way and posted this information on a purpose-built website community that I started[3]. Today this website sees more than 20,000 visitors a month and features contributions from some of the world's most specialized engine builders and world record holders.

It was my education in physics and science, combined with my real world experience as a mechanic, which landed me my first "real" job in the work force as a technical documentation writer at a pharmaceutical automation packaging company. I was writing user manuals for safe operation of robotic equipment, and while this wasn't the dream job I had in mind, it helped me get some experience that I could leverage to find my next job.

It didn't take more than 6 months after I started the technical writing job before I was interviewing for some analyst positions in finance and web-related companies. I got my foot in the door at an IT firm that employs just over 1,000 people and was offering a competitive starting salary with room to grow as a web analyst. They found it valuable that I had experience running my own websites, and since I was coming from a physics background I was

more than familiar with Excel and analyzing data sets. While working as a web analyst I took some evening classes in accounting and have since been promoted to business analyst, I now work daily with Business Intelligence data cubes to examine financial trends in sales data and provide predictions, growth models, ROI analysis, and monthly presentations to explain the results to the VPs and directors.

The lesson in all of this is that employers aren't out there looking for physicists to offer jobs to; on the contrary, most job postings mention other degrees, years of experience and soft skills. That's why it's our responsibility (as physicists) to find something that interests us and to enlighten the world as to why someone with a physics degree is going to be able to do that same job, but better. We have an edge on the competition and it goes beyond just having the required skill set.

Physics is a field where you are essentially learning how to learn; the thought processes and problem solving skills developed while studying are a gift that will benefit you for the rest of your career and life in ways you can't even imagine right now. No matter which job or task you take on, the strengths of your education in physics will shine through; from programming and finance, banking and insurance, business, pharmacy, labs, construction, music and the arts, everything is accessible from a physics student's perspective and completing that degree is like planting a seed, and you continue to plant seeds as you expand your knowledge and try to learn as many new things as possible. As time goes on, those seeds grow and blossom into opportunities.

So to answer the question posed in the title of this article: Well, if you spin it right, you can do anything you want to do.

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PROFESSIONAL DESIGNATIONS IN PHYSICS: CANADA AND AROUND THE WORLD

BY SHASHI K PATHAK, P.PHYS., CPHYS, FINSTP

Physics is an integral part of our day-to-day life. It is heavily embedded in our idea of systemic development, provides the foundations for many scientific disciplines, and enhances living standards and the quality of life through innovative research and technological advances. Achieving excellence and recognition together in the field of Physics is no less a daunting task as it does not solely depend on developing a good understanding of the subject: it also requires an exceptional ability to communicate and disseminate knowledge and understanding to the outside world, to the public and to the scientific community.

A professional designation at a glance may offer that key element of excellence and recognition to a certain extent. Other than establishing the bar of academic excellence, it may also signify a necessary core of competence and professional standards of an individual in the field. Due to these factors, professional designations in the dawn of the 21st century have acquired a reasonably high importance, not only from a "recognition" point of view but also from an employment perspective. While these are normally earned from a university or a professional society specializing in a specific field, there are various types of certifications that offer specific designations to be used after an individual's name.

It is a matter of considerable interest that the number of professionals in today's economies acquiring such designations is steadily rising. Although this growth may be largely attributed to factors that arise due to changing employment situations and a thirst for recognition and achievement, there are nonetheless several tangible benefits associated with it. Since these certifications are portable, they are not employment-specific as they are not associated with a certain job. Popular certifications in Physics have either been created or affiliated with professional organizations with an interest to recognize individuals in their area of expertise. Accordingly, these designations are renewed periodically depending upon their validity, and applicants are expected to show evidence of continued learning as a part of the renewal process. For obvious reasons, this article will remain focused on professional designations in Physics; however, it will provide a limited account of other popular designations for information and comparative analysis.

SUMMARY

Professional designations around the world have attained widespread recognition and credibility in identifying a standard level of skills, experience and expertise of individuals. This article reviews how these increasingly popular titles have created a positive impact in the workplace by promoting merit and excellence.

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PROFESSIONAL DESIGNATIONS IN PHYSICS IN NORTH AMERICA, EUROPE AND OTHER PARTS OF THE WORLD

One of the popular designations in Physics in North America, called "Professional Physicist," (P.Phys.) is offered by the Canadian Association of Physicists (CAP). Similarly, other well known designations, such as"Chartered Physicist" (CPhys) and "Fellow, Institute of Physics," (FInstP) offered by the Institute of Physics (IoP) are popular around Europe and other countries.

Professional Certifications and the Standard of Chartered Status

A professional certification signifies a commitment to the profession that helps employers to choose the best. This is a part of an ongoing process, as one needs to maintain a professional certification through professional learning activities on a continual basis. This also confirms to employers that an individual is committed and competent, and this enhances the individual's employability and likelihood for promotion. Similarly, chartered status is the aspiration of members engaged at the leading edge of all fields of physics and its applications.

Achieving chartered status is considered prestigious, as it denotes a high level of expertise and specialized knowledge in the area, along with professional competence. The requirements for attaining and maintaining chartered status have significantly advanced since the inception of this title and have always been a part of a continuous review process. From an employer's perspective, chartered professionals are efficient and valuable for employment for good business reasons. They can provide expert

advice and professional judgment, based on their excellent skills. Thus, the holders of chartered status and professional designation titles are considered not only to be cost-effective and outcome-oriented, they are also well-qualified to take a holistic approach in providing reasonable solutions.

Designation Offered by the CAP

The Canadian Association of Physicists (CAP) offers the professional designation P.Phys. to its members who meet certain academic and professional standards. Historically, this program was approved in 1997 and later launched in 1999 at the CAP Congress held at the University of New Brunswick, with the first designation being awarded to Nobel Laureate Bertram Brockhouse during the Congress. Since then, considerable efforts have been made to ensure the quality and applicability by including a Professional Practice Examination and a specific code of ethics for the members of the P.Phys. community. The "Professional Physicist" designation certifies that an individual is qualified, experienced, and therefore capable of making appropriate decisions in her/his area of expertise. From the employment perspective, the designation not only helps in identifying the professional standard of an individual, it also confirms to employers and the public a high level of competence and credibility in the field. P.Phys. holders in general are expected to contribute to the development of Physics and strive to enhance knowledge in Physics. P.Phys. holders agree to uphold the CAP's code of professional ethics and conduct and must recertify their P.Phys. title every five years by submitting documentation demonstrating that they are making efforts to stay current (professional development) and active in their field. P.Phys. designation indicates that holders of this title are well-qualified and that they possess effective communications skills and outside-the-box thinking that distinguish them from the crowd. In addition, the P.Phys. certification is not limited to pure academics, but extends its horizons to physics careers in government, industry, and other areas where training in Physics is used on a regular basis.

Designations Offered by IoP

Another widely recognized professional designation, Chartered Physicist (CPhys), is exclusive to the Institute of Physics (IoP), in the UK. CPhys is a chartered status and a professional qualification that indicates the highest standards of professionalism, up-to-date expertise, quality and safety, and a capacity to exercise leadership and undertake independent practice. According to the IoP, the title carries with it a commitment to keep pace with advancing knowledge and with the increasing expectations that society has of professionals. Chartered Physicists agree to abide by a code of conduct that requires members to show not only a high level of professionalism, but also to continually advance their competence through continuing professional development (CPD). For this reason, Chartered Physicists are expected to revalidate their CPhys title by submitting an up-to-date CV and CPD record every three years. In addition, the IoP confers Fellowships to those who have made an outstanding contribution to their profession. Holders of this designation are popularly known as Fellows of the Institute of Physics (FInstP). Fellowship indicates a very high level of achievement in physics and an outstanding contribution to the profession. Fellows are entitled to use the designatory letters "FInstP" after their name.

Thus, the Institute's professional designations CPhys and FInstP come as a feather in one's cap. The titles CPhys and FInstP remain not only popular and highly recognized in academia, but are also well-known in industry and research organisations as important recognitions and honors.

DISSEMINATION AND SCIENTIFIC OUTREACH

Dissemination and outreach activities are essential components of a professional organization in order to promote and popularize its professional designation. It is a well-known fact that both the IoP and the CAP are highly active in disseminating knowledge and scientific outreach, thereby helping to enhance physics research and education. For example, there are a number of resources available to IoP and CAP members on a regular basis. There is a regular array of activities organized by the CAP and IoP through their groups/divisions and, in the case of IoP, branches that include a series of interesting events in relation to Physics developments. These may include, but are not limited to, scientific meetings, education & career events, policy discussion meets, public and outreach activities, business briefings and invitation-only events for businesses, etc. As briefly mentioned earlier, both the IoP and the CAP are highly involved in policy discussions and activities that may include briefings to explain physics-related issues to key stakeholders and responses to government consultations. They also undertake a variety of other activities and outreach programmes to the public. One interesting aspect confirms the concept that IoP resources are not limited to higher-education academia, and a suitable access along with easy communicative link is available for physicists in Primary Schools too. IoP ensures that there are number of activities in the area for engaging physicists at the school level that include Curriculum Development Initiatives, Affiliated Schools Scheme, and Professional Development Courses etc. Similarly, the CAP also organizes various outreach activities that help spread physics news and its applications throughout academia and schools on a regular basis.

CERTIFICATIONS IN ALLIED AREAS OF PHYSICS

At this time, professional certifications in allied areas of physics appear to be limited to Medical Physics designations, although other physics sub-disciplines, like meteorologists and oceanographic scientists, are exploring the possibility of introducing a professional designation in their subfield. Within the medical physics community, the professional designations are widely administered by certification bodies, rather than through the professional association. In these cases, there is

usually a symbiotic relationship between the two independent organizations. In the US, the American Board of Radiology (ABR) approves professional certification in Medical Physics. In Canada, the Canadian College of Physicists in Medicine (CCPM) offers certification of competence in clinical medical physics. European Commission Directives govern Medical Physics Experts in Europe and the European Federation of Organizations for Medical Physics (EFOMP) certifies the knowledge skills and competences of individuals. In the UK, the process of accreditation and certification is through the Scientist Training Programme (STP) that leads to accreditation with the Institute of Physics and Engineering in Medicine (IPEM). In order to advance services and professional standards in medical physics, the Australian College of Physical Scientists & Engineers in Medicine (ACPSEM) is the professional body that oversees the education and accreditation of medical physicists in Australia and New Zealand.

OTHER POPULAR PROFESSIONAL DESIGNATIONS

There is considerable growth in professional and chartered designation titles in all possible areas of Physical Sciences, Arts, Finance and Medicine.

The popular professional designations PE and P.Eng. denote the status of a professional engineer in US and Canada respectively. These are highly regarded and regulated. The Canadian Engineering Accreditation Board (CEAB) accredits all Canadian undergraduate engineering programs whereas parallel functions are performed by the Accreditation Board of Engineering and Technology (ABET) in the United States. The Statistical Society of Canada offers two levels of accreditation: the entry-level Associate Statistician (AStat), and the Professional Statistician (PStat) which requires six years of professional experience. In the US, the American Institute of Chemists (AIC) offers Certified Professional Chemist (CPC) and Certified Chemical Engineer (CChE) designations to recognize chemists and chemical engineers who have a certain level of education and experience. In Canada the Professional Chemist designation (PChem) is administered by the Association of the Chemical Profession for each province that has established specific procedures and requirements for license or registration within that province.

Chartered status, in particular, is a common and well-known credential for professions in the UK and Europe where specific skills and professionalism is required. For example, the title Chartered Biologist is a British professional qualification in biology where members use the designation CBiol after their names. Similarly, Chartered Chemist (CChem) is a chartered status awarded by the Royal Society of Chemistry (RSC) in the UK, the Royal Australian Chemical Institute (RACI) in Australia and the Institute of Chemistry Ceylon (IChemC) in Sri Lanka. Furthermore, Chartered Scientist (CSci) and Chartered Engineer (CEng) are professional designations offered by the Science Council in the UK and by the Engineering Council UK (ECUK) respectively. Chartered Statistician (CStat) is a professional qualification in statistics offered by the Royal Statistical Society in the UK with post-nominal letters CStat. Last but not the least, Chartered Mathematician is a professional qualification that comes with the title CMath offered by the Institute of Mathematics, UK.

CONCLUSION

In general, professional designations are common and well-known credentials which are an effective means to convey professional competence in a bird's eye view. Thus, it may be reasonable to address certain aspects of professional designations in terms of their current role, requirements, and practices.

With respect to the Canadian P.Phys. designation in particular, as the CAP is growing, so is the acceptance of P.Phys. amongst professionals in Canada and the US. Most of the universities and academic institutions in North America do recognize the credibility and competence of this designation. There is a need to create a stronger credible impact of P.Phys. in professional and scientific circles in order for it to be widely recognized and valued, especially amongst industries and applied technical institutions. In addition, at this time the popularity of P.Phys. in other parts of the world remains limited. This is expected to change as more Canadian physics graduates obtain this designation and work outside of Canada.

Another dominant factor affecting a more rapid recognition of the P.Phys. and CPhys designations is that, unlike professional engineering designations which are a regulated requirement to practice engineering, professional physics designations are not needed to practice physics. Gaining widespread recognition of the value and significance of these physics designations is a very important aspect related to enhancing the impact of the designation on employment opportunities within the physics profession. While it is hard to disseminate and depict a futuristic view of a similar regulated fate for professional designations in physics, physics as a discipline is growing, and in anticipation, the sky is the limit. The time is not too far away when professional physics designations like P.Phys. and CPhys will be a standard part of professional practice.

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THE CAP DESIGNATION OF PROFESSIONAL PHYSICIST – WHO AND WHY

BY ZIN TUN, P.PHYS.

Richard Feynman once rebutted to an artist who said scientists cannot see the beauty of a flower because, with their knowledge, they dissect the flower into its basic constituents - the atoms and molecules - and the beauty is destroyed [1]. Feynman contends that even an atom in isolation is "beautiful" with its intricate display of perfect symmetry. His thesis was *knowledge always adds, never subtracts*.

Bertram Brockhouse is on record saying we do not do something just because we have the knowledge for doing it. Bert gave a highly relevant example for Canada—the knowledge we have for how to extract energy from atoms, is not sufficient, on its own, for developing nuclear energy. We are reminded to give careful consideration of how the knowledge we have as physicists is used [2].

These statements by Nobel Laureate physicists are thought provoking for physicists since many are engaged, directly or indirectly, in the search for knowledge. The knowledge acquired can be used constructively or destructively. Often legal or regulatory frameworks concerning the use of the new knowledge are not in place, and will not be for many years after the pioneering work. This stands in contrast with the situation for some other professions where a clear set of rules and limitations exist to guide the practitioner.

SUMMARY

History has proven time and again that Physicists' work can have far reaching impacts in society as a whole. Throughout their career physicists must be mindful of this possibility, and act responsibly and ethically. Professional certification requires that they do so.

A scientist is not able to predict the reach of his or her work. Yet, it could have the potential of affecting the entire world and therefore the precision and correctness of assessing the future impact of the "product" is far more imperative than for some other professions.

Many professions in Canada are regulated or regulate themselves for a variety of reasons. Typically, professional regulation is in place to protect the "client", either from personal or financial risks associated with the activities of that profession. For natural scientists in Canada, the "client" is, at its root, all Canadians. More broadly, one could say that the client is in fact the whole world.

Some professions, like engineers, lawyers, trades such as electricians/plumbers, or healthcare providers, are governed by federal or provincial law. As natural scientists are not a regulated profession, the Canadian Association of Physicists (CAP) chose to approach this issue in a different way. Though not the first, the CAP opted to introduce and trademark "Professional Physicist" or "P.Phys". By means of a certification process with specific criteria and guidelines [3], the CAP can limit the use of the P.Phys. title to only those who are licensed by the CAP.

In lieu of a strict regulatory framework, the CAP has developed the Code of Ethics [4]. Adherence to this code is the minimum standard expected of all members to ensure they act responsibly for the benefit of society, clients and employers, the Physics profession, and to themselves. In addition an expanded code of ethics [5] has been developed for the holders of the P.Phys. A P.Phys. is a CAP member who has made the pledge to be bound by this expanded code, and in the view of the CAP, he/she has demonstrated a level of proficiency and/or professional conduct required to uphold the pledge.

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THE MECHANICS OF SCIENTIFIC PUBLISHING, PEER REVIEW, AND ETHICS IN PUBLISHING

BY MICHAEL STEINITZ, P.PHYS.

SUMMARY

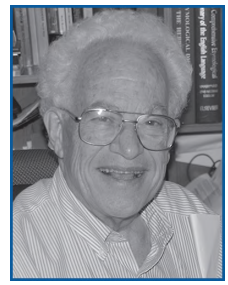
What is the editor looking for, what is the process for submitting a paper, how does peer-review work, and what ethical principles should govern the presentation of your work?

This paper is a condensed version of a short-course given at the National University of Mexico, UNAM, in Mexico City last year. The discussion centers on what your editor is looking for, and what, exactly, it is that he or she does. The information and anecdotes included here arise from the author's experience as editor of the *Canadian Journal of Physics* (*CanJPhys or CJP*) published by NRC Research Press/Canadian Science Publishing.

Scientific content is central to this, but a recurrent concern is about questions of attribution of textual material used and the avoidance of any possible implications of plagiarism or duplicate publication. Communication is an essential part of the scientific endeavour. It is often stated that, "If you cannot communicate what you have done (verbally and in writing) then you haven't done it!" Whether we like it or not, English has become the world-wide language of communication and a working knowledge is a great, if not essential, part of preparation to becoming a working scientist. For authors who do not have this knowledge, a friend or colleague with good English skills is a crucial asset. To write well requires not only language skill, but an understanding of how to write briefly and concisely in a manner that will inform and interest a reader who is not a specialist in the author's narrow sub-field.

What is your editor looking for and what does he do? The editor is looking for new and novel ideas, interpretations or results, which will be of interest to the readers of the journal. A cover letter outlining why the author chose this particular journal and why they think the manuscript might be of interest to that journal's readers is always helpful.

The editor is assisted by Associate Editors who are specialists in the various subfields of physics. They assign papers to referees who are experts on the topic at hand. The referees, associate editors, and, ultimately, the editor, are looking for work that contributes significantly to the structure of the body of knowledge that we, as scientists, are building. It must be new, interesting to the community served by the journal, and clearly and concisely communicated. The editor and associate editors are usually assisted by computer software that keeps track of the status of submissions, by software that aids in finding referees, and by software that aids in detecting plagiarism. Two external referees are usually used, although the associate editor may occasionally choose to act as one of the referees. It is the prerogative of the editor and the associate editors to choose to reject a paper without review if it is deemed to be better suited for publication in a more specialized journal or if it is judged to be obviously unscientific or nonsensical.



My father, also a physicist, taught me when I was a schoolboy, that the FIRST qualification for being a scientist is ABSOLUTE HONESTY. What follows from this?

a. You must be totally scrupulous in your references to everything that has gone before you on the topic you are working on. You should make references to all recent work that has led up to yours, and, if necessary, indicate one or two works that might contain a comprehensive set of references leading back to the earliest work on the topic.
b. You cannot use ANY text or data that anyone else has published without putting it in "quotes" and making an explicit reference. I get about one case every week at the *CanJPhys* in which an author has violated this rule.
   i. Most common is repeated publishing, i.e. submitting a paper to us that the author has already published elsewhere, in an effort to expand his or her list of publications. Google™ is great for discovering this, and we also have plagiarism-detection software that indexes about 37,000 journals. You *will* be found out and then will receive a letter indicating that we will *never* accept a submission from you again.
   ii. The worst kind of such misconduct (about one every month for *CanJPhys*) is copying the work of someone else. This is just as easy to detect.

Michael Steinitz, <msteinit@stfx.ca>, Editor of the *Canadian Journal of Physics*

and

Professor of Physics, Department of Physics, St. Francis Xavier University, P.O. Box 5000, Antigonish, NS B2G 2W5

> In this case the President of the author's university or company will get a letter from us showing the evidence without making any judgement, as the editor cannot act as both "police" and judge in matters external to the journal, and also as the editor would not want to be sued in court over any presumed accusations. Any action arising at the author's institution following receipt of this information is strictly a matter for the authorities at that institution. The authors, of course, get the same letter stating that we will *never* accept a submission from them again.

Such questions of integrity all have consequences for both the authors and for the editors. A few months after accepting the editorship of *CanJPhys* I attended a talk by a former editor of the American Journal of Physics. He told of an irate author who came to his office with a revolver. Luckily, the editor was away from the office and his secretary eventually recovered from the fright. Although I have been threatened with lawsuits after rejecting a paper, and have had angry letters attacking my integrity, impartiality and even my presumed ethnicity, I am glad to say that no such violent incident has ever happened to me.

A paper that is ready for submission must be well organized and written in clear, acceptable English (or either English or French for *CanJPhys*). It must state:

a. What the problem is that was investigated.
b. Why it is interesting.
c. How the study was carried out.

ONLY THEN do you begin to present results.

In an experimental paper, ERROR BARS are essential, along with general statements about the resolution, accuracy and reliability of your measurements. In a theoretical paper you must also indicate confidence limits on your results.

Comparison with previous experimental or theoretical work that motivated your study comes next.

If English or French is not the author's first language, then it is advisable, if not essential, to have a colleague who is a native speaker of the language of your article go over your manuscript.

Writing should be as brief and clear as possible, allowing an informed physicist who is NOT a specialist in the specific subfield addressed in the paper to understand the work presented.

Grammar and spelling are essential to making your paper understood. For $9.99 you can buy a copy of "The Elements of Style" by Strunk and White (at Amazon or other booksellers). This will help you learn how to eliminate nonsense and where to put the commas!

In summary, learning to write well, and to know how to navigate the seas of publishing, are essential parts of the education of a 21st century physicist. Some graduate programs include courses on this, which may be very helpful. If this is not part of your program, you might want to investigate how and where you could take such a course. It will probably serve you well throughout your career.

Product Development: An Engaging Career for Physicists

by John Walmsley, P.Phys.

Within a day of his birth, my first son had a routine hearing test. A volunteer balanced a heavy handheld device on the bassinet and used it to characterize the returned signal from an acoustic pulse sent into each ear in turn. My son passed the test. I was fascinated by the combination of physics and physiology involved but my most abiding memory is my concern that the heavy device was going to fall onto my son!

Product Development is the process that creates devices such as the hearing screener from market need to initial concept to final, polished, manufactured product. For the hearing screener to become a successful product, many elements needed to be right: the core algorithm had to work, a volunteer needed to find it easy to use accurately, the hospital system had to have been able to afford it and, of course, it can't hurt the kid being tested.

The Product Development team gets these elements right by identifying and solving a long series of problems that block the creation of the device. What's more, the problems need to be understood and solved well enough to enable a manufacturing team to make thousands of devices. Finally, putting those thousands of devices in the hands of users, in my mind, maximizes the value of the solution.

The people working in these Product Development teams are often engineers but my purpose in writing this article is to point out that Product Development offers an interesting and engaging career for physicists.

My perspective on this is informed by the job that I do. I am a physicist and the company that I work for, StarFish Medical (Fig. 1), employs over 40 engineers and physicists in Victoria, BC.

Of those, 20% are graduates that we have hired in the last two years. StarFish Medical is a product development consultancy focused on creating innovative medical devices for clients and then readying those devices for market. Mostly the devices involve different types of electrical and mechanical systems working together and controlled by software. We have worked on disparate devices: some as complex as haemodialysis and ultrasound machines, some as simple as syringes and some as virtual as apps in the App Store. We have, by coincidence, also helped develop the next generation of that hearing screener – we took the opportunity to give it a hook to keep it safely attached to the bassinet.

Our company was founded and is still led by an Engineering Physicist and we employ physicists who do software, electronic and mechanical design. We also look to physicists to fulfill the roles of project manager and systems engineer. In other product companies where I've worked, physicists have been sales people, marketing managers, financial comptrollers and general managers responsible for operations. Companies who have hired StarFish also employ physicists in similar roles. Several have physicists as CEOs. In each case, the physicists have been able to rely on their ability to understand complex technical situations quickly and efficiently.

Physicists bring a training that encourages us to see the whole problem, conceptualize it and then simplify it in ways that allow the problem to be solved more straightforwardly. We have a facility for recognizing patterns at a range of scales and using the scientific method to confirm that we are on the correct path. We don't mind exploring boundary conditions, reversing the timeline, making order of magnitude estimates and performing controlled experiments to work our way through a new situation. Finally, our degree gives us a context for understanding most technologies, even if we haven't met the specifics before. All of these skills give physicists an advantage in the work of Product Development where, as I've said, there are many unknown problems to be discovered, defined and resolved.

Summary

Product Development provides a lifelong career with opportunities to apply physics and physics thinking. I describe one career and offer hints on getting a job in the field.

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Fig. 1 Starfish Medical working environment.

WHAT CAN A CAREER LOOK LIKE?

My personal path to being responsible for the Starfish Medical team who do this work started with a physics degree at the University of Bristol in the United Kingdom. I was an undergraduate there during the late 1980s and, at the time, the most obvious paths for a Bristol physics graduate were either a PhD in particle physics or, in contrast, a job with one of the large London-based management consultants. When I started my degree, I chose physics because it interested me and I assumed that I would progress to a PhD in some specific area that excited me. As I worked towards completing my degree, it became clear to me that obtaining a PhD was not what I wanted to do. I also did not want to join the ranks of management consultants. I discovered through career advertisements that I could combine my interest in gadgets with my physics degree by becoming part of a team that brought products to market. I started applying for such jobs. Unfortunately, this was at the start of a recession and none of the companies that I spoke to were hiring people who didn't have any direct work experience.

My pragmatic solution was to do an MSc in a field that interested me but that, importantly, would give me practical work experience in an area that seemed about to boom: fibre-optics. My MSc taught me the fundamentals of opto-electronics and gave me hands-on time with lasers in the lab. Perhaps even more importantly, the MSc gave me the chance to do an internship at the leading industrial research centre in the field, British Telecom's Research Labs. When the time came to apply for work in the field of fibre-optics, it made a big difference to hiring managers that I had already demonstrated an interest in this area and that they could talk to my internship supervisor and hear from him that I could quickly become a productive member of their team.

My first professional job title was Development Engineer with a company called BT&D Technologies (a joint venture of British Telecom and Dupont). My very first task was to characterize some new long-haul communication transmission semiconductor lasers. These Distributed FeedBack (DFB) lasers had two inherent modes of operation that could cause a 'kink' in the output characteristic and we couldn't ship lasers where that happened. My MSc meant that I was already aware of this property and suited to make the measurements. Quickly, it made sense to automate the testing and because I had been programming since I was a young teenager, I was glad to look after this. As time passed, I was given responsibility for a small but important side-project. Here I learned the skills of customer management, production coordination, and project management. During any week, I could be solving problems related to the intermetallics in non-eutectic solders, crack propagation in glass fibres, optimization of software to speed up test times and talking a customer through a tricky production delay. Clearly, I needed to rely on experienced colleagues to get up to speed in many of my tasks, but I found that the general grounding I had acquired from my undergraduate physics training provided me with a context for all of it, and I never felt lost.

On my first day at BT&D, the company had announced the commercial availability of the first Erbium Doped Fibre Amplifier. This was the final technological piece to enable the full capability of fibre-optics and marked the beginning of a decade-long fibre-optics boom, powering the expansion of the Internet and the welcome collapse in long distance phone rates. It was a thrill to be doing my part to make the world a smaller place.

During that boom, I moved to Canada, relying on my fibre-optic expertise to get a job doing similar work here in Victoria. (By the way, all long-haul amplifiers are still powered using a fibre-Bragg-grating stabilization method invented and commercialized by a physicist based here in Victoria.) When the boom came to its sudden end, I moved to the Bay Area of California and spent a further two years doing a similar job before coming back to Victoria and StarFish Medical.

It was my expertise in project management and the introduction of new products to manufacturing that got me the job in medical device production with StarFish. At the time, I knew little about medical devices themselves but my fundamental understanding of physics gave me the head start I needed to get up to speed quickly in a wide range of medical technologies.

HIRING CRITERIA

Now, as VP of Product Development with StarFish Medical, I find myself in a position where I look to hire bright, enthusiastic graduates who can quickly be productive for the company and our clients. At StarFish, we look, first of all, for candidates who want to develop products and are willing to push forward to solutions that will support the completion of

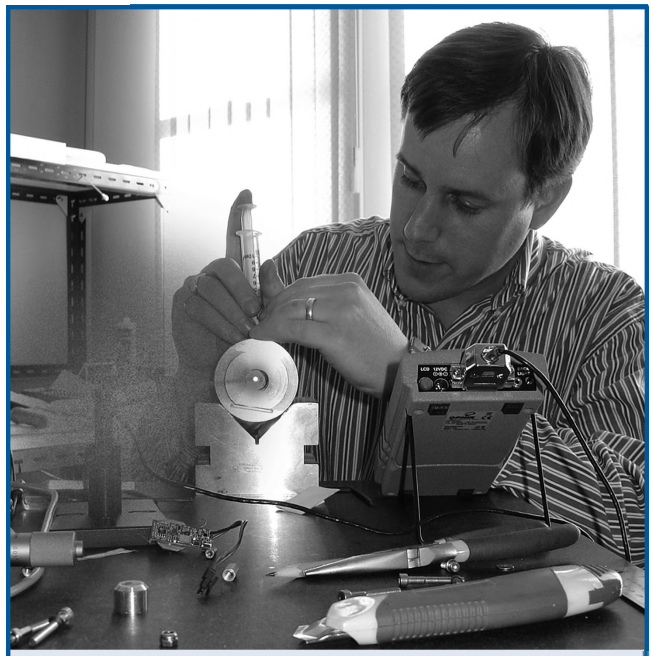

Fig. 2 Kenneth MacCallum, Principal Engineering Physicist, adjusts a laser.

product designs. We also look for individuals with a demonstrable capacity in a skill that we need so that we can have confidence that they will be productive in some way right from the start. Our recent graduates are currently contributing to a range of interesting and challenging projects (Fig. 2), including: optics systems for cancer margin assessment and to control infection in hospitals; mechanical systems to control the injection of therapeutic stem cells; ultrasound systems for imaging of the body both generally and within the heart; microprocessor C programming for a variety of applications from motor control to data capture; 3D imaging representation systems; and user interface creation.

With experience, some new recruits will specialize in algorithm development, coding, circuit design or fluid mechanics. Others will take a path where they use their general knowledge to tie systems together, managing the interactions and risks as the various components are integrated into a device. Others will manage project teams so that the product is developed and ready to launch within the client's budget and timelines.

SO YOU THINK YOU WANT A CAREER IN PRODUCT DEVELOPMENT?

During an interview, a hiring manager is looking for evidence that you will enjoy and be successful in the work of the job that you are applying for. Good managers will understand that a new graduate needs support as they build their skills and experience in the early stages of their career. Given a choice of candidates, however, they will prefer someone who has already

pulled together their knowledge and experience to achieve something because they will probably be able to do it again.

The best evidence for this manager is a hands-on project that you have completed on your own initiative, whether by yourself, with your local maker club, or with friends. Many physicists find that programming is an accessible skill. Using low-cost platforms such as the Arduino or Raspberry Pi, you can build useful skills while demonstrating a real interest in technology by creating an interesting and challenging demonstration project.

Of course, an excellent way to build a portfolio of interesting work is to take full advantage of the co-op program at your institution. To get the best effect, you should work with the coordinators to identify good opportunities that match your interests or let you test the depths of those interests. Don't limit yourself to companies that have already connected with the co-op program. Reach out to managers at companies that align with your interests and find out if there are options to spend time there. When you are on site with the co-op company, ask to be exposed to diverse opportunities - and don't forget to complete something useful while you are there.

CONCLUSION

Product development represents an opportunity to make a real difference in the world. The possibilities for physicists in product development are many and varied. I've illustrated just a sampling of those with reference to my own career and the work of my current employer, StarFish Medical. There are many other similar opportunities for physicists in Canada. The specialisms and the paths to them are wide-ranging. With attention to gaining and maintaining relevant experience and skills, it is possible to have a rewarding, long career in product development.

THE CANADA/NORWAY STUDENT SOUNDING ROCKET PROGRAM (CANOROCK)[1]

BY DAVID M. MILES, IAN R. MANN, DAVID J. KNUDSEN, KATHRYN A. MCWILLIAMS, KOLBJØRN DAHLE, JORAN GRANDE, JØRAN MOEN, ERIC V. THRANE, ARNE HANSEN, UNNI P. LØVHAUG, I. JONATHAN RAE, A. KALE, BRIAN J. JACKEL, JOHNATHAN K. BURCHILL, AARYA SHAHSAVAR, ERIC M. GRONO, AND COLLIN CUPIDO[2]

SUMMARY

The Canada–Norway Student Sounding Rocket (CaNoRock) program is a multi-university collaboration to train undergraduate students in space science or engineering, and to recruit them into space related graduate studies or industry.

Space weather, the volatile near-Earth magnetic, plasma and radiation conditions caused by the interaction of the Sun's output with the Earth's magnetic field, is increasingly recognised as a significant risk to ground and space infrastructure. For example, the senior US and UK science advisors recently estimated the potential cost of a severe space weather event at "$2 trillion during the first year in the United States alone, with a recovery period of 4 to 10 years" [1]. The future prediction and mitigation of space weather effects requires a better understanding of the underlying space physics plasma processes.

Continued progress in space physics requires ongoing and expanded in-situ measurements from near-Earth space and the training of the next generation of highly qualified engineers and scientists. The spacecraft which provide these measurements typically cost tens to hundreds of millions of dollars and operate on decade long timescales. This poses a particular challenge for space physics education. Student participation can be viewed as an intolerable risk given the cost of the mission. Additionally, when students are involved, they see only pieces of the process as their academic program spans a fraction of the mission duration.

The governments of Norway and Canada have both recognized the need to foster expertise in space to maintain and expand their objectives in space research and technology development. The Canada/Norway Sounding Rocket Program (CaNoRock) uses student rocket activities as a high profile talent magnet to attract undergraduate students into space-related career paths, to enhance discovery learning through practical hands-on instruction, and to create an exceptional learning environment for undergraduate students. The ultimate goal of CaNoRock is to build scientific and technological research capacity by helping undergraduate students to transition into space-related graduate study and industry. This paper describes the on-going program, the student recruitment success, and proposed additional programs, all designed as an innovative approach to developing the future space workforce.

THE CANOROCK PROGRAM

CaNoRock is a collaboration between the Canadian Universities of Alberta, Calgary and Saskatchewan; the Norwegian Universities of Oslo, Tromsø, Bergen, and the University Centre at Svalbard (UNIS); the Andøya Space Center; and the Norwegian Centre for Space Related Education (NAROM). The program, which is undertaken with the financial support of the Canadian Space Agency, was officially opened by the Canadian ambassador, John Hannaford (Fig. 1) in January 2011.

1. An earlier version of this manuscript was presented at the 63rd International Astronautical Congress, Naples, Italy, 1–5 October 2012.

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Fig. 1 CaNoRock students with Canadian ambassador John Hannaford (centre).

CaNoRock was conceived as a ten year program to train undergraduate and graduate students in experimental space science. Two CaNoRock courses are run each year – one in the spring term and one in the fall term. For each program, twenty Canadian and Norwegian undergraduate students travel to the Andøya Space Center in northern Norway and undertake a complete, but scaled down, sounding rocket campaign. This allows the course to cover all the phases of an experimental space physics mission compressed into five days.

Fig. 2 Launch of a CaNoRock student sounding rocket.

A WEEK OF EXPERIMENTAL SPACE PHYSICS AND ENGINEERING

In five days the CaNoRock students build and test instrument payloads, integrate them with a student sounding rocket, participate in all aspects of the rocket launch (Fig. 2), and analyse the resulting data. The students work under the guidance of scientists, engineers, technicians and other professionals from NAROM and the Andøya Space Center. Instructional topics include: introduction to rocketry, trajectory analysis, payload integration, data analysis, space and atmospheric science, and telemetry. There are also keynote lectures given by leading academics from Canada and Norway, as well as guided tours of facilities at the Andøya Space Center and the Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR). The students deliver a final report to their home university and are eligible for five credits in the European Credit Transfer and Accumulation System (ECTS) from the course through the University of Oslo.

The CaNoRock learning environment is demonstrated by one of the conceptually simple challenges given to the students: to predict and then measure the altitude of the rocket flight. The students are divided into groups, each is assigned an aspect of the problem to focus on under the supervision of a topic expert, they complete their tasks in parallel, and finally they integrate their findings to complete the challenge.

One group of students begins by modelling the nominal rocket trajectory. After applying the well understood rules of mass, force, and drag they quickly discover that the calculation is sensitive to the aerodynamics of the rocket, as well as the wind on the ground and at altitude. Fortunately, another group has been studying atmospheric science and measures the wind profile using a meteorological balloon. Combining this data and the developed model gives a nominal flight profile and altitude sufficient for the student instrument group to implement and optimise an altimeter using a car-tire pressure sensor. The student payload group interfaces this altimeter to the on-board computer and radio link. Finally, the student telemetry group has trained to operate the space center's steerable antennas and has configured the signal processing equipment at the center to match the frequency, encoding, and data format transmitted by the student rocket. After launching the rocket, the students work together to analyse the data, comparing their predicted flight profile with the altitude inferred by their measurements of the in-situ atmospheric pressure (Fig. 3).

In addition to formal technical instruction such as this, CaNoRock also provides exceptional networking opportunities for the undergraduate participants. During the five day residential course, the students live, work, and eat at the Andøya Space Center. This provides many opportunities to mingle and interact socially with space center personnel, university lecturers as well as space scientists and engineers from other sounding rocket campaigns that may be active at the space center at the same time. CaNoRock alumni have reported that these informal interactions made space-related studies feel less intimidating and encouraged them to consider space as a viable career choice. Participants are also asked to do outreach for the program when they return to their home institutions to help recruit the next contingent of undergraduates (Fig. 4).

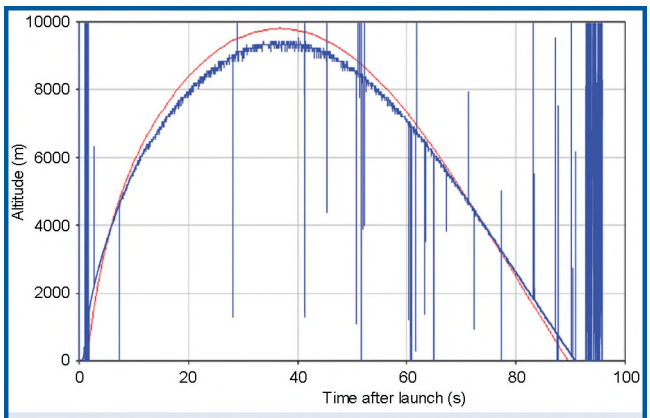

Fig. 3 Comparison of the predicted (red) altitude versus the measured (blue) altitude profile from a CaNoRock student sounding rocket.

Fig. 4 CaNoRock student Katherine Maguire presents at the 2011 ISSET Space Exploration Symposium at the University of Alberta. Photo credit: Katherine Maguire.

CANADIAN STUDENT SURVEY RESULTS

A follow up survey was completed with the alumni from the first seven CaNoRock courses to assess the impact of the program. The survey focused on concrete outcomes where students had entered or completed space related academic or industry positions. The survey was conducted by email in March 2013 and received 30 responses from a possible 65 alumni (46% response rate). The responses indicated that:

- 20% of respondents had applied to work or were working for a company in the aerospace industry; an additional 20% intended to apply when they graduate.
- 67% of respondents had completed an undergraduate research program, design project, or summer student position; 65% of these projects were space related.
- 57% of respondents had applied to or enrolled in graduate studies; an additional 20% intended to apply when they graduate.

Overall, the course was highly rated by the Canadian participants with feedback such as: "Great experience. It's a good eye-opener for undergraduate physics students who don't otherwise have any exposure to space science."

STUDENT CASE STUDIES

CaNoRock attracts students who have a demonstrated interest in space science or engineering, as well as students who are uncertain about career options but have aptitudes in applied physics and engineering. Alumni of the program have gone on to pursue both academic and industrial career paths in space-related fields. The following three case studies illustrate the role of CaNoRock in helping students define their career objectives.

Eric Grono – University of Calgary

Eric Grono was a third-year physics student at the University of Calgary when he was selected to attend CaNoRock in October 2010. Being in Norway made such an impression on him that he decided to finish his degree at the University of Oslo. Through careful planning, Eric was able to complete all course requirements (including General Relativity, Gas Dynamics, Quantum Mechanics, and a research project on craters on Mercury), and transfer credits back to Calgary without delaying his graduation. CaNoRock also inspired Eric to pursue a Master's degree and now a PhD in Space Physics at the University of Calgary using the aurora to investigate magnetospheric plasma processes under the supervision of Professor Eric Donovan.

Aarya Shahsavar – University of Saskatchewan

Aarya Shahsavar was in his second year of Engineering Physics at the University of Saskatchewan when he was encouraged to apply to CaNoRock by an alumnus of a previous campaign. Mr. Shahsavar was the president of the University of Saskatchewan Space Design Team (USST) when he travelled to Norway; his team was competing in the Canadian Satellite Design Challenge (CSDC) to design a student nanosatellite [2]. While in Andøya, Mr. Shahsavar had access to telemetry experts at the Space Center with whom to discuss design elements of the USST telemetry systems. Mr Shahsavar credits his time at the Andøya for the USST finalizing their telemetry system in time for the Critical Design Review, and for their success in the CSDC competition.

Mr. Shahsavar feels that CaNoRock enhanced the professional and personal development of the students involved and that the cultural elements are important regardless of a participant's future career choices. Mr Shahsavar has built on his successes; in 2012 he was invited to present a talk titled "Space – The Next Real Marketplace?" [3] at TEDx Winnipeg's "The Next Big Thing" event (Fig. 5).

Fig. 5 CaNoRock student Aarya Shahsavar presents at a 2012 TEDx event in Winnipeg. Photo credit Jamie Townsend.

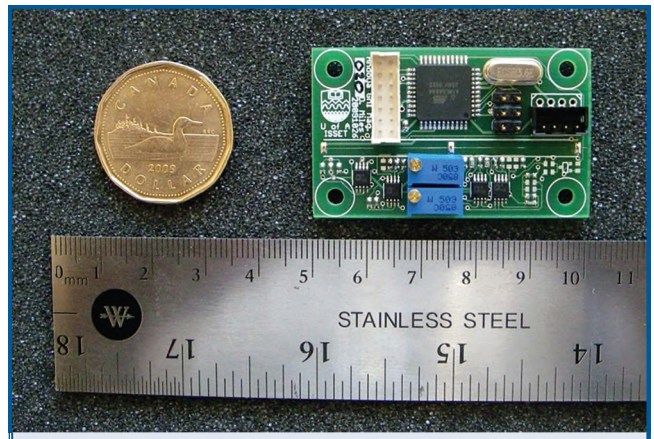

Fig. 6 Prototype giant magnetoimpedance effect magnetometer test flown on the first CaNoRock student sounding rocket.

David Miles – University of Alberta

David Miles was an MSc student at the University of Alberta when he was invited to be a Co-Investigator on the first CaNoRock campaign. In addition to completing the field course in Norway, Mr Miles developed a miniaturised magnetometer (Fig. 6) based on the giant magnetoimpedance effect in a nanofibre, calibrated the instrument, and test flew it on a CaNo Rock student sounding rocket. The success of this experience set the precedent for an additional laboratory component of the program now being developed at all three Canadian Universities in which undergraduate students develop scientific instruments to be flown during the week-long Norwegian field course.

Mr Miles successfully defended his MSc thesis "Towards a Radiation Hardened Fluxgate Magnetometer for Space Physics" [4] in 2012 and began PhD studies. Based in part on the successful CaNoRock collaboration, Mr Miles and his supervisor were offered science team membership in the Norwegian Investigation of Cusp Irregularities (ICI) sounding rocket program and a no-cost flight of their fluxgate magnetometer on the Norwegian ICI-4 sounding rocket which launched successfully in February 2015. Mr Miles is using the instrument flight and science data from ICI-4 as part of his PhD thesis. Mr. Miles was also invited to join the Canadian Space Agency Cassiope/e-POP satellite science team for which he handles the day-to-day operations of the magnetometer payload, coauthored the instrument paper [5], and developed software to transform the raw magnetometer data into an operational data product for international dissemination.

CANOROCK-STEP FOLLOW-ON PROGRAMS

The on-going CaNoRock undergraduate program has been successful in increasing student interest in space related

graduate studies and careers. The follow-on Canada-Norway Rocket Science Training and Educational Program (CaNoRock-STEP) program is intended to help participating students transition from graduate studies into scientific research by providing mobility funding and hosting PhD summer schools. CaNoRock-STEP creates opportunities for joint Canada-Norway collaborative, research-led active training and education that builds on the educational content of CaNoRock. CaNoRock-STEP received a $2 million NOK grant in 2012 from the Norwegian Centre for International Cooperation in Education (SIU), which is a public Norwegian agency promoting international cooperation in education and research.

The first CaNoRock-STEP PhD school was held in November of 2013 at the University of Calgary's Barrier Lake Research Station in the mountains near Kananaskis, Alberta, Canada. The course focused on large statistical studies using ground-based data from the SuperDARN radars and space-based data from the CHAMP and AMPERE satellite missions. The school led to a publication in the Journal of Geophysical Research: Space Physics [6] on frictional heating in the ionosphere and a second manuscript on pointing flux in the ionosphere which is in revision. The second PhD school ran at the Andøya Space Center in summer 2014 and focused on using data from the recently launched Swarm satellites to understand the creation and evolution of polar cap electron patches. In two weeks, the nine students and their advisors selected events, analysed data, and developed two manuscripts which were published in Geophysical Research Letters [7,8].

CONCLUSIONS

The on-going CaNoRock student sounding rocket program has demonstrated its effectiveness in attracting and retaining undergraduate students in space related studies. Future programs will provide additional learning opportunities including student exchanges, participation in scientific sounding rocket campaigns, and cube-satellite projects. These ongoing and future programs will provide hands-on undergraduate and graduate level opportunities to train the next generation of highly qualified space personnel.

ACKNOWLEDGEMENTS

This program was undertaken with the financial support of the Canadian Space Agency and the University of Alberta Teaching and Learning Enhancement Fund. This collaboration would not have been possible without the support and cooperation of: the Canadian Space Agency; the Andøya Space Center; the Norwegian Centre for Space-related Education, the Institute for Space Science, Exploration and Technology (ISSET); and the Universities of Oslo, Tromsø, Bergen, UNIS, Calgary, Saskatchewan and Alberta. Miles is supported by a Canadian NSERC PGSD2 graduate scholarship. Canada-Norway Mobility funds for the CaNoRock STEP were provided by the Norwegian Centre for International Cooperation in Education (SiU), project NNA-2012/10099. This project has also received economic support from the Research Council of Norway, grant 230996.

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(as at 2015 December 31 / au 31 décembre 2015)

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SUMMARY OF THE 51ST ANNUAL CANADIAN UNDERGRADUATE PHYSICS CONFERENCE AT TRENT UNIVERSITY

BY JAMES GODFREY

The Canadian Undergraduate Physics Conference (CUPC) is an annual conference hosted by undergraduates across Canada, with the host university changing annually. CUPC is an important event in the Canadian undergraduate physics community, having run annually for the last 51 years. CUPC brings together some of Canada's brightest young minds for 4 days of enriching plenary lectures and undergraduate research presentations, and to strengthen attendees' passion for physics as a whole. Indeed, CUPC has been known to create lifelong bonds between young physicists. This year, Trent University had the honour of hosting the CUPC from October 22nd to 25th, for the first time ever since the conference's inception in 1965.

[C]ANADIAN [U]NDERGRADUATE [P]HYSICS [C]ONFERENCE

2015

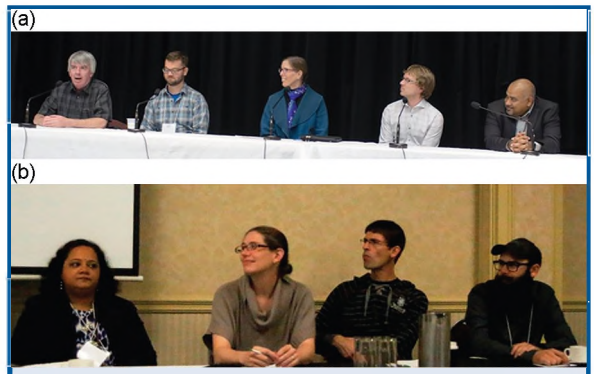
TRENT UNIVERSITY

Co-Chairman Alan Godfrey welcoming delegates during the Thursday evening reception.

SUMMARY

The annual conference has an impressive history of having been organized by a team of undergraduate students at various schools across the country for the past 50 years. CUPC 2015 continued that proud tradition, at Trent University.

Poster and lecture presentations of undergraduate delegates' research, the core of CUPC, were incredibly diverse, with presenters traveling from all across Canada to present their original work. It is empowering to see that young physicists can significantly impact their field so



(a) (*left to right*) Dr. Robert Blyth, Stephen McMurtry, Prof. Rachel Wortis, Julian Atfield, and Dr. Suresh Narine taking questions from delegates during the 2nd Annual Career Panel on Saturday afternoon.
(b) (*left to right*) Dr. Chitra Rangan, Dr. Lilian Childress, Prof. James Fraser and Sean Arruda answering delegates' questions during the 2nd Graduate Studies Panel on Sunday morning.

James Godfrey, Trent University, Co-Chair of CUPC 2015 and CAP's Councillor Representing Undergraduate Student Affiliates

CUPC 2015 BY THE NUMBERS

Attendees (Undergraduates):	198
Student Talks:	114
Plenary Speakers:	4
Panelists:	9
Attendees (Total):	227
Posters:	30
Booths at Graduate and Career Fair:	37
Sponsors:	19

early in their careers. The Graduate Studies and Career Fair on Sunday morning, a pillar event, was very well-attended, both in terms of delegates and representatives from academic and industrial institutions.

Two panel events introduced last year, the Career and Graduate Studies Panels, were continued in this year's iteration of CUPC. This year's Career Panel featured Prof. Rachel Wortis of Trent University; Dr. Robert Blyth, Science Projects Manager at Canadian Light Source; Julian Atfield, Trent U. alumnus and Reactor Physicist at Canadian Nuclear Laboratories; Dr. Suresh Narine, Director of the Trent Centre for Biomaterials Research; and Stephen McMurtry, Trent U. alumnus and Data Visualization Specialist. The Graduate Panel featured Prof. James Fraser (Queen's), Dr. Chitra Rangan (U. Windsor), Dr. Lilian Childress (McGill), and MSc candidate Sean Arruda (Queen's). Both events were entirely driven by delegates' questions for the panelists; topics covered included panelists' pursuits of a career in physics, life in academia and industry, and many others. Both events were very well-received by delegates, with the length of the Career Panel being doubled from last year.

CUPC 2015 EVENT SUMMARY

Thursday, October 22, 2015
- Registration
- James Fraser: Keynote

Friday, October 23, 2015
- Patricia Burchat: Keynote
- Student Research Talk Block 1
- Patricia Burchat: Seminar
- Student Research Talk Block 2
- CUPC Pub Crawl

Saturday, October 24, 2015
- Student Research Poster Block
- Lab Tours
- Paul Torrey: Keynote
- 2nd Annual CUPC Career Panel

Sunday, October 25, 2015
- 2nd Annual CUPC Grad. Studies Panel
- Graduate Studies & Career Fair
- Student Research Talk Block 3
- General Meeting/Bids for CUPC 2016
- Paul Corkum: Keynote
- Banquet
- Presentation Awards

One of the co-founders of CUPC, Dr. Calvin Kalman, delivered an opening address at the Thursday night reception, sharing his account of CUPC's humble beginnings: a story of what has blossomed into a celebrated tradition in Canada's undergraduate physics community, from a small conference involving only 3 universities. Following Dr. Kalman's address, Prof. James Fraser (Queen's) delivered a plenary lecture briefly discussing his research in coherent imaging, depth-controlled laser welding and physics education, as well as discussing the importance of keeping an open mind when thinking about career paths in the coming years and physics in general.

(a) Prof. James Fraser delivering a plenary lecture the opening night of CUPC 2015.
(b) Dr. Paul Torrey lecturing on cosmological simulations on Saturday afternoon, prior to the Career Panel.
(c) Dr. Paul Corkum speaking to delegates Sunday night at the closing banquet. *Not pictured: Dr. Calvin Kalman and Dr. Patricia Burchat.*

Co-chairmen Alan Godfrey (*bottom left*) and James Godfrey (*bottom, 2nd from left*), and the CUPC 2015 organizing committee. *Pictured: (left to right, top row) Julian Christopher, Emily Korfanty, Paul Schell, Jessica Auchterlonie, Eamonn Corrigan, Taylor Armitage, Andrew Grace, Cale Fortin; (left to right, bottom row) Brayden Hull, Edward Sweeny, Yuchen Song. Not pictured: Jeet Trivedi, Matthew Cole, Jayme Stabler.*

Prof. Patricia Burchat (Stanford) delivered a plenary lecture on Friday morning, discussing the building, capabilities, and underlying physical principles of the Large Synoptic Survey Telescope. The afternoon of the same day, Prof. Burchat also delivered a very informative and interactive seminar on applying to graduate schools in North America and abroad. Preceding the Career Panel on Saturday, Dr. Paul Torrey (MIT) delivered a keynote talk about his work with cosmological simulations and the future of high performance computing, sharing both his wisdom and gorgeous deep sky images. At the closing banquet dinner on Sunday evening, Dr. Paul Corkum gave an enlightening talk about molecular orbital 'selfies' and the foundational principles of attosecond physics, an extremely relevant area in physics today.

In summary, CUPC 2015 was an incredibly inspiring and worthwhile weekend for all in attendance. The organizing committee could not be happier with the result: an uncompromising, enriching, financially sustainable, and extremely well-received conference organized entirely by undergraduate physics students. Trent University's CUPC 2015 Organizing Committee wishes the best for the coordinators of CUPC 2016 at Dalhousie University. We are confident that this illustrious piece of undergraduate physics tradition will thrive for years to come.

Science Policy Update

by Kris Poduska, Director of Science Policy

Le point sur la politique scientifique

par Kris Poduska, directrice de la politique scientifique

These are exciting times for science policy in Canada. With so many personnel and policy changes coming into play at the federal level, it can be hard to anticipate how these changes could affect the physics community.

An excellent resource for gaining different perspectives on how science and government policies can interface is the website for the Canada Science Policy Centre (www.sciencepolicy.ca). Highlights from the 2015 Canadian Science Policy Conference are posted, including descriptions, summaries, and videos. Physics interests figure prominently in Nobel Laureate Dr. Art McDonald's video speech in which he emphasizes the importance of funding big science. A session on evidence-based decision making generated a series of recommendations that are posted online as a working document. There are also videos of various talks and speeches given during the conference. Two examples include a speech by the Hon. Kirsty Duncan, who was recently appointed as the Canadian Minister of Science and a presentation by Sir Peter Gluckman, Chief Science Advisor to the Prime Minister of New Zealand made during the keynote panel discussion entitled "Science Advice to Government" (other speakers included Alan Bernstein, President & CEO of CIFAR, Arthur Carty, Executive Director of the Waterloo Institute for Nanotechnology, and Rémi Quirion, Chief Scientist Officer, Fonds de recherche du Québec). Taken together, these collections of commentaries and summaries show that there is great interest in having a strong working relationship between science and government policy in Canada.

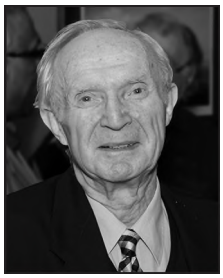
La période en cours est passionnante pour la politique scientifique au Canada. Les changements au niveau fédéral sont si nombreux sur les plans du personnel et des politiques qu'on peut avoir du mal à prévoir en quoi ils toucheront la collectivité de la physique.

Le site Web du Centre canadien de la politique scientifique (www.sciencepolicy.ca) est un excellent moyen de connaître différents points de vue sur la manière dont peuvent se recouper la politique en matière de sciences et celle du gouvernement. On y trouve les faits saillants de la Conférence sur les politiques scientifiques canadiennes 2015, dont des descriptions, résumés et vidéos. L'intérêt pour la physique du lauréat du prix Nobel, le D^{r} Art McDonald, transparaît en gros plan dans sa conférence vidéo où il fait valoir l'importance de financer la mégascience. Une séance sur la prise de décision fondée sur des preuves a donné lieu à une série de recommandations qui sont affichées en ligne à titre de document de travail. On trouve aussi les vidéos de divers propos et conférences pendant la conférence. À titre d'exemples, mentionnons la conférence de l'hon. Kirsty Duncan, qui venait d'être nommée ministre des Sciences du Canada, et un exposé du conseiller scientifique principal du Premier ministre de la Nouvelle-Zélande, Sir Peter Gluckman, lors du débat du groupe d'experts, intitulé « Conseils au gouvernement en matière de sciences » (autres conférenciers: Alan Bernstein, Président & PDG de CIFAR, Arthur Carty, Directeur exécutif de l'Institut de nanotechnologie de Waterloo, et Rémi Quirion, expert scientifique en chef, Fonds de recherche du Québec). Ensemble, ces séries de commentaires et de résumés montrent que nous avons tout intérêt à entretenir une relation très étroite entre les sciences et la politique du gouvernement au Canada.

Would you like to know more about CAP's role in shaping science policy? Are you interested in getting involved? In either case, please feel free to contact me (kris@mun.ca).

Si vous voulez en savoir plus long sur le rôle de l'ACP dans l'élaboration de la politique scientifique ou que vous êtes intéressé à vous impliquer, n'hésitez pas à communiquer avec moi (kris@mun.ca).

Michael K. Craddock (1936–2015)



Michael K. Craddock, UBC Emeritus Professor, retired TRIUMF Research Scientist, and CAP member since 1972 passed away in Vancouver on November 11, 2015 following a brief illness. He was one of the founding fathers of TRIUMF, who was present at the moments the idea for the lab was conceived and when the first beam emerged. He worked tirelessly on the cyclotron and other key projects for 50 years, including 33 years as TRIUMF's head accelerator physicist until his retirement in 2001.

Mike Craddock was born April 15, 1936 in the United Kingdom. He received his Bachelor's and Master's degrees in Mathematics and Physics at Oxford University in 1957 and 1961, respectively. He was a Scientific Officer at Rutherford Appleton Laboratory while pursuing a D.Phil. in Nuclear Physics at Oxford, which was awarded in 1964. Upon graduation Mike joined the Physics Department at the University of British Columbia (UBC), where he remained throughout his career.

Originally hoping simply to conduct experiments at UBC's Van de Graaf accelerator, he was thrust almost immediately into the department's campaign to build a new accelerator on campus. Tasked by Prof. John Warren to investigate options for a new machine, he recommended a modified version of the H^- cyclotron design of Reg Richardson at UCLA. Mike managed the overall specification, which settled on scaled down 500 MeV, 20 μA machine. The TRIUMF proposal was approved by the Canadian government in 1968, and from then until 1978 he was the beam dynamics group leader. In this period his most memorable challenge was being responsible for determining the position and number of the magnetic shims installed during the massive field-shaping campaign around 1973–74. Mike's reward came when he was present at Reg Richardson's shoulder as the first beam emerged December 15, 1974.

Mike was TRIUMF's leading beam physicist throughout his career, from joint head of the Beam Development Group from 1978–81 (under Director Jack Sample), then as Accelerator Research Division head from 1982–88 and head of the Accelerator Division from 1989–94 (under Erich Vogt), to group leader for Accelerator Physics from 1995 until his retirement in 2001 (under Alan Astbury). He was one of the chief architects of the KAON Factory Project, where as deputy to project leader Astbury, he led a multi-disciplinary team in the engineering design of a suite of synchrotron-type proton accelerators. KAON was unable to attract federal funding and so Mike set to work on projects related to the Large Hadron Collider (LHC) accelerator injector chain at CERN, the success of which raised the lab's profile worldwide. Remarkably during all this time he supervised over fourteen graduate students, regularly taught undergraduate and graduate physics courses, and acted as TRIUMF's correspondent for the CERN Courier journal.

Retirement did little to tamper Mike's relentless energy. He joined the Accelerator Development Group (led by Rick Baartman) and worked on several projects before settling on Fixed-Field Alternating Gradient Accelerators (FFAGs) from 2004–12, where he participated in an international project to build a 20 MeV electron model (EMMA) at Daresbury, UK. He was a constant presence at the lab, where e.g. he organized conferences, or presented introductory accelerator physics lectures to students at TRIUMF, UBC, and the University of Victoria, all the while acting as TRIUMF's unofficial historian, which included many talks on the lab's history.

During a career that spans five indefatigable decades, Mike demonstrated exceptional leadership in the field of high-energy subatomic particle physics, notably in particle accelerator design and construction, and he was instrumental in fostering new generations of accelerator physicists in Canada and abroad. A testament to his outstanding character, before he passed, Mike made a very thoughtful and generous gift to TRIUMF establishing the Michael Craddock Fund for Accelerator students at TRIUMF.

His passing has been felt around the world and has left a gaping hole in the TRIUMF family. He will be sorely missed by all who knew him.

Michael Craddock lived in Vancouver, BC. He had one son, Barnaby, a stepdaughter, Vanessa, and a stepson, James, and was predeceased by his wife Sonia. In lieu of flowers, donations can be made to the St. John Hospice, the Pancreas Centre BC (both via the BC Cancer Foundation or the Vancouver General Hospital), or the newly established Michael Craddock Fund for Accelerator students at TRIUMF (via TRIUMF).

The author wishes to acknowledge the invaluable contributions of Shane Koscielniak, Garth Jones, Ewart Blackmore and others in the preparation of this article.

Marcello Pavan
TRIUMF

Shew-Kuey (Tommy) Mark (1936–2015)

Shew-Kuey (Tommy) Mark, Sir William C. Macdonald Professor Emeritus of Physics at McGill University, passed away on Friday March 13, 2015 in Toronto after a long and illustrious career.

Professor S. K. Mark was born on August 8, 1936 in Guangdong, China. He moved to Canada in March 1950 at the age of 13. After graduating from the Byron Byng High School in Montreal, he came to McGill, and graduated with a B.Sc. (Honours Mathematics and Physics) in 1960. He then joined the University's Foster Radiation Laboratory as a graduate student and completed an M.Sc. in nuclear physics in 1962, and a Ph.D. in 1965 under the supervision of Professors T. M. Kavanagh and Robert Moore. After one year as a postdoctoral fellow at the University of Manitoba, he returned to McGill as a Lecturer in 1966 and rose through the ranks: He was promoted to Assistant Professor in 1967, to Associate Professor in 1970, and to Full Professor in 1975.

Tommy Mark's scientific career has been rich and diverse. He was a pioneer in the experimental study of nuclear reaction mechanisms, and some of his careful measurements have fuelled the development of the theoretical nuclear optical model. Many of his groundbreaking results were instrumental in the elucidation of the properties of light nuclei. In addition, he took an interest in the highly unstable nuclei that could be produced uniquely by the McGill Cyclotron. This work provided the foundation for a new program at that facility. He conducted a fruitful and pioneering systematic investigation of the neutron-deficient nuclei far from the beta stability valley. He studied these nuclei as a function of proton number and neutron number so as to facilitate the discrimination between various nuclear models. In 1971 – only a year after being promoted to associate professor – he was named Director of the Foster Radiation Laboratory, succeeding such renowned scientists as J. S. Foster and Robert Bell. That Laboratory was at the time one of the most important university laboratories in Canada. A major renovation of the synchrocyclotron was then initiated and completed under his leadership. This rejuvenation of the laboratory's main research instrument built immediately after the war by Professor J. S. Foster – allowed the acceleration of a new set of heavier beams, and paved the way for a major renewal of the laboratory's research program which consolidated the unit's leadership in the spectroscopic study of unstable nuclei.

In 1982, Tommy was appointed Chair of the Physics Department, a position he held until 1990. Thanks to his tireless work and powers of persuasion, he managed during this period to create many new positions and attracted to McGill a new generation of bright young researchers. This renaissance in the department initiated an immediate growth of research funding, accompanied by a large increase in the number of students, undergraduates and graduates. Indeed, he always emphasized the teaching mission of the university, and cared deeply about the training and mentoring of students. Under his chairmanship, educational undergraduate laboratories were renovated and the entire academic curriculum was reviewed. Students of all levels always found in him an attentive ear; he could provide advice and encouragement and also knew how to listen and how to respond to their needs. Tommy practiced what he preached: he personally supervised a large number of students and young researchers who now occupy important positions in research, education, industry, and in the public service. He was a model for his trainees, and was able not only to convey his contagious enthusiasm for research, but also to instil a sense of work ethics and of discipline.

In 1987, towards the end of his term as Chair of the Department, Tommy decided to reorient his research, and started at McGill an experimental research program in a new area – relativistic heavy ion physics. This subfield studies nuclear matter under extreme conditions of density and temperature with methods and techniques that straddle nuclear and particle physics. Early in the program, he joined the E814 experiment at the Brookhaven National Laboratory (BNL), a collaboration studying the reaction dynamics induced by beams of ^{16}O and ^{28}Si at a bombarding energy of 15 GeV/nucleon. In 1992 he also contributed to the first generation of experiments with beams of relativistic ^{197}Au nuclei at the BNL Alternating Gradient Synchrotron (AGS). Those pioneering experiments have played a crucial role in our current understanding of the space-time evolution of the hot, strongly interacting matter produced in high-energy heavy-ion collisions. Just before his retirement in 2004, Tommy had become the Canadian leader in the PHENIX collaboration, one of two major experiments at the Relativistic Heavy Ion Collider facility, at BNL. His lifetime of accomplishments was recognized in 2002 when he was named W.C. Macdonald Professor of Physics, thereby adding to a list of distinguished McGill chair holders that includes Sir Ernest Rutherford.

Tommy always devoted a large part of his immense talent and energy to serving the scientific and academic

communities. He has served on many committees within and outside McGill. Notably, he was president of a national grant committee before reaching the age of forty, and also played an important early role in the Canadian Institute of Particle Physics. In his administrative duties as in every other aspect of his career, Tommy pursed excellence with rigour, fairness, and relentless persistence. He firmly believed in the development of research in Canada and in its ability to be globally competitive. He was a champion of science.

Professor Tommy Mark perfectly embodied the university scholar who has successfully integrated the highest levels of excellence in research and in teaching, and who has selflessly and continuously given back to the community. He was a source of inspiration not only to his students and colleagues, but also to all who knew him. He will be missed.

Jean Barrette, John E. Crawford, Charles Gale, Jonathan P.K. Lee
McGill University

2016 CAP Congress Program Highlights

Faits saillants du programme du Congrès de l'ACP 2016

(Visit http://www.cap.ca/en/congress/2016 for speakers' abstracts and bios.)

(Visitez le http://www.cap.ca/fr/congres/2016 pour les résumés et biographies des conférenciers.)

Herzberg Public Lecture

Prof. Victoria Kaspi
Department of Physics, McGill University
"*The Cosmic Gift of Neutron Stars*"
Monday, June 13, 19h30
(the lecture will be preceded by a welcome BBQ for Congress delegates on campus and will be followed by a cash-bar reception at the Shaw Centre)

Conférence publique Herzberg

Pr Victoria Kaspi
Département de Physique, Université McGill
« Le don cosmique des étoiles à neutrons »
Lundi 13 juin, 19 h 30
(précédé par un barbecue de bienvenue pour les délégués du Congrès sur le campus et suivi d'une réception avec service de bar payant au Centre Shaw)

Plenary Lecturers

Prof. Hendrik Schatz
National Superconducting Cyclotron Laboratory
Michigan State University
"*Nuclear Astrophysics with Radioactive Beams*"
Monday, June 13, 9h30

Prof. Russell Jacobs
Beckman Institute / Caltech Brain Imaging Center
California Institute of Technology
"*Uses and abuses of μMRI and simultaneous μPET/μMRI: A Chemists talks with Physicists about Biology*"
Tuesday, June 14, 15h00

Prof. Paul Corkum
Canada Research Chair in Attosecond Photonics
University of Ottawa
"*Probed quantum systems from the inside – on the attosecond time scale*"
Thursday, June 16, 17h15

Conférenciers pléniers

Pr Hendrik Schatz
National Superconducting Cyclotron Laboratory
Michigan State University
« L'astrophysique nucléaire à l'aide de faisceaux radioactifs »
Lundi 13 juin, 9 h 30

Pr Russell Jacobs
Beckman Institute / Caltech Brain Imaging Center
California Institute of Technology
« Usages et abus des μIRM et des μTEP/μIRM simultanés : échanges d'un chimiste avec des physiciens en biologie »
Mardi 14 juin, 15 h 00

Pr Paul Corkum
Chaire de recherche du Canada en photonique de l'attoseconde
Université d'Ottawa
« Systèmes quantiques sondés de l'intérieur – à l'échelle de l'attoseconde »
Jeudi 16 juin, 17 h 15

Other Special Events

Department Leaders Business Meeting
Tuesday, June 14, 17h30

Student-Industry Meet & Mingle
Tuesday, June 14, 17h30

Poster Session
Tuesday, June 14, 19h00

CAP Annual General Meeting
Wednesday, June 15, 17h15–18h30

Autres événements spéciaux

Réunion d'affaires des directeurs de départements
Mardi 14 juin, 17 h 30

Rencontre de réseautage étudiants-industrie
Mardi 14 juin, 17 h 30

Session d'affiches
Mardi 14 juin, 19 h 00

Assemblée générale annuelle de l'ACP
Mercredi 15 juin, 17 h 15 – 18 h 30

Professional Practice Development Session
Wednesday, June 15, 18h45–19h30

Special session celebrating 100 years of research at NRC
Wednesday, June 15, 19h30–21h30

New Time Slot! CAP Best Student Oral Competition Finals
Thursday, June 16, 15h15–17h15
(Results at Recognition Reception)

CAP Recognition Reception
with honoured guest Art McDonald who will be presenting the awards and will be giving a short talk on his experiences since being awarded the 2015 Nobel Prize in Physics.
Thursday, June 16, 19h30–22h00 at the Shaw Centre

Session de développement d'exercice professionnel
Mercredi 15 juin, 18 h 45 – 19 h 30

Session spéciale pour célébrer 100 ans de recherche au CNRC
Mercredi 15 juin, 19 h 30 – 21 h 30

Nouvelle case horaire! Finale de la compétition des présentations orales étudiantes de l'ACP
Jeudi 16 juin, 15 h 15 – 17 h 15 (Résultats au Gala de reconnaissance)

Gala de reconnaissance
avec l'invité d'honneur, Art McDonald, qui y présentera les prix et donnera une courte allocution sur les expériences vécues depuis qu'il a reçu le Prix Nobel 2015 en Physique.
Jeudi 16 juin, 19 h 30 – 22 h 00 au Centre Shaw

2016 INVITED SPEAKERS / *CONFÉRENCIERS INVITÉS 2016*

(Invited speakers in joint sessions appear after the individual division lists / *La liste des conférenciers invités aux sessions conjointes apparaît après les listes individuelles*)

DAMOPC/*DPAMPC*

BOYD, Robert
University of Rochester / University of Ottawa
Quantum Information and Structured Light Fields

CHILDRESS, Lilian
McGill University
Spins, photons, and defects in diamond

DOLGALEVA, Ksenia
University of Ottawa
(tba)

JELIC, Vedran
University of Alberta
(tba)

MADEJ, Alan A.
NRC, York, U. Ottawa
Realization of an Ultra-Accurate Single Atom Atomic Clock at the Quantum Mechanical Stability Limit

MCGUIRK, Jeffrey
Simon Fraser Univsity
Nonclassical diffusion in a nondegenerate ultracold gas

OZAKI, Tsuneyuki
INRS - EMT
(tba)

VUTHA, Amar
University of Toronto
Tentative: Using atomic clocks to search for gravitational waves

DASP/*DPAE*

DRUMMOND, James R.
Dalhousie University
(tba)

LOVEJOY, Shaun
McGill University
(tba)

NOKES, Charles
University of Alberta
(tba)

THOMPSON, David
Queen's University
(tba)

VALDES, Julio J.
National Research Council
(tba)

WUNCH, Debra
University of Toronto
(tba)

DHP/*DHP*

PANTALONY, David
Canada Science and Technology Museum
Magnetism in Canadian History, from the 1839 Observatory to Space Weather

ROY, René
Université Laval
De Rome à Québec: Rasetti fonde le département de physique il y a 75 ans

DNP/*DPN*

CABALLERO, Liliana
University of Guelph
Neutron star mergers: neutrino emission and nucleosynthesis

JEON, Sangyong
McGill University
Characterizing Quark Gluon Plasma - The hottest and densest matter

KALITA, Mukut Ranjan
TRIUMF
Search for a permanent electric dipole moment of the Ra-225 atom

KANUNGO, Rituparna
Saint Mary's University
Exploring exotic phenomena at the drip-lines with reaction spectroscopy at IRIS

LASCAR, Daniel D.
TRIUMF
Advances in Mass Measurements at TITAN

MUECHER, Dennis
University of Guelph
Probing Nuclear Shell Evolution using Radioactive Ion Beams at ISOLDE, CERN

SCIELZO, Nicholas
Lawrence Livermore National Laboratory
Tests of the electroweak interaction from studies of the beta decay of trapped 8Li ions

SPYROU, Artemisia
NSCL, Michigan State University
Constraining neutron capture rates far from stability and astrophysical implications

DPMB/*DPMB*

ANIS, Hanan
University of Ottawa
(tba)

BEAULIEU, Luc
Laval University
(tba)

deKEMP, Robert
University of Ottawa Heart Institute
(tba)

GOYAL, Sidhartha
University of Toronto
(tba)

HARDEN, James
University of Ottawa
(tba)

LONGTIN, Andre
University of Ottawa
(tba)

LU, Qing-Bin
University of Waterloo
(tba)

THIESSEN, Jonathan
Lawson Health Research Institute
(tba)

WALLIN, Stefan
Memorial University of Newfoundland
(tba)

DPP/*DPP*

BHARDWAJ, Ravi
University of Ottawa
(tba)

ROZMUS, Wojciech
University of Alberta
(tba)

VARIN, Charles
University of Ottawa
MicPIC perspectives on light-matter interactions in strongly-coupled systems

DTP/*DPT*

McGRATH, Paul
University of Waterloo
A Farewell to Symmetries: Quasilocal Frames in General Relativity

PARANJAPE, Manu
University of Montreal
(tba)

JOINT SESSION SPEAKERS / *CONFÉRENCIERS DES SESSIONS CONJOINTES*

DAMOPC-DCMMP/*DPAMPC-DPMCM*

JOLY, Nicolas
Max-Planck Institute for the Science of light
Generation of nonclassical states using photonics crystal fibres

POON, Joyce
University of Toronto
(tba)

DAMOPC-DPP/*DPAMPC-DPP*

DAS, Gautam
Lakehead University
Detection of trace gases and chemicals using fiber laser technology

DIAP-DIMP/*DPIA-DPIM*

BLAIS-OUELLETTE, Sébastien
Photon etc
(tba)

GALARNEAU, Pierre
INO, Québec
A physicist at INO: an employer and an employee

MOREAU, Christian
Concordia University
(tba)

THIBAULT, Simon
Université Laval
(tba)

DTP-DCMMP/*DPT-DPMCM*

LAGOWSKI, Jolanta
Memorial University of Newfoundland
Investigations of the Intermolecular Interactions between Organic Conjugated Monomers, and Conjugated Oligomers and Nanotubes Using Dispersion-Corrected DFT

DTP-DNP-PPD/*DPT-DPN-PPD*

SVENNE, Juris
University of Manitoba
(tba)

This list was compiled in early January and is, therefore, incomplete and subject to change. Visit http://www.cap.ca/en/activities/2016-congress-ottawa/invited-speakers for the most recent list.

Cette liste a été compilée au début du mois de janvier. Elle est incomplète et sujette à changement. Veuillez visiter http://www.cap.ca/fr/activities/2016-congress-ottawa/conferenciers-invites.

2016 Herzberg Public Lecture Speaker

University of Ottawa
Monday, 13 June 2016 – 19h30

Prof. Victoria Kaspi
Department of Physics
McGill University

The Cosmic Gift of Neutron Stars

"Although they are thousands of light years away, neutron stars can act as very precise cosmic beacons – a celestial gift that sheds light on some of the most interesting problems in modern science. We will explore these strange objects, explain how astronomers are using them to study issues ranging from the origins of the Universe to the very nature of matter, and even listen to the cosmic symphony they create."

Biography Notice

Victoria Kaspi is a Professor of Physics at McGill University, where she holds the Lorne Trottier Chair in Astrophysics and Cosmology, and a Canada Research Chair in Observational Astrophysics. She is also Director of the newly created McGill Space Institute.

She received a B.Sc. (Honours) in Physics from McGill University in 1989, and an M.A. and Ph.D. in Physics from Princeton University in 1991 and 1993 respectively. From 1994–96, she held a Hubble Postdoctoral Fellowship at the Jet Propulsion Laboratory and California Institute of Technology. She was an Assistant Professor of Physics at the Massachusetts Institute of Technology from 1997–2000, and joined the McGill Department of Physics in 2000.

Prof. Kaspi uses techniques of radio and X-ray astronomy to study rapidly rotating, highly magnetized neutron stars. She has done significant work involving radio pulsars and magnetars. More specifically, she has contributed among other things to the study of binary pulsar dynamics, the neutron star population, as well as the study of magnetars, the most highly magnetized objects known in the Universe.

Prof. Kaspi has been the recipient of numerous awards and honours, including the Killam Prize in 2015, NSERC's John C. Polanyi Award in 2011, the Prix du Québec in 2009, the Harvard University Sackler Lectureship in 2009. She is the R. Howard Webster Foundation Fellow of the Canadian Institute for Advanced Research, and a Fellow of the Royal Society of Canada. In 2010 she was inducted as a Fellow of the Royal Society of London, and elected to the U.S. National Academy of Sciences, and was inducted into the American Academy of Arts and Sciences in 2015.

Conférence commémorative publique Herzberg 2016

Université d'Ottawa
Lundi, 13 Juin 2016 – 19h30

Prof. Victoria Kaspi
Département de physique
Université McGill

Le don cosmique des étoiles à neutrons

« Bien qu'elles soient à des milliers d'années lumières, les étoiles à neutrons peuvent être des balises cosmiques très précises – un don céleste qui éclaire certains des problèmes les plus intéressants de la science moderne. Nous examinerons ces objets étranges, expliquerons comment les astronomes s'en servent pour étudier les questions allant des origines de l'Univers à la nature même de la matière, et écouterons même la symphonie cosmique qu'ils créent ».

Notice biographique

Victoria Kaspi est professeure de physique à l'Université McGill où elle est titulaire de la chaire Lorne Trottier en astrophysique et cosmologie, et de la Chaire de recherche du Canada en astrophysique d'observation. Elle dirige en outre l'Institut de l'espace de McGill, nouvellement créé.

Elle se voit décerner un B.Sc. (concentration) en physique de l'Université McGill en 1989, ainsi qu'une maîtrise et un doctorat en physique de l'Université Princeton, respectivement en 1991 et 1993. De 1994 à 1996, elle est boursière de recherches postdoctorales Hubble au Jet Propulsion Laboratory et au California Institute of Technology. Elle est professeure adjoint de physique au Massachusetts Institute of Technology de 1997 à 2000 et entre au Département de physique de McGill en 2000.

La prof. Kaspi emploie les techniques de radioastronomie et d'astronomie en rayons X dans l'étude des étoiles à neutrons à rotation rapide et à fort rayonnement électromagnétique. Elle réalisera d'importants travaux ayant trait au pulsar radio et aux magnétars. Elle contribue notamment à l'étude de la dynamique des pulsars binaires, la population d'étoiles à neutrons, et à celle des magnétars, objets au plus fort rayonnement électromagnétique connus dans l'Univers.

La prof. Kaspi se voit décerner de nombreux prix et honneurs, dont le Prix Killam en 2015, le Prix John C. Polanyi du CRSNG en 2011, le Prix du Québec en 2009, et le poste de chargé de cours Sackler de l'Université Harvard en 2009. Elle est boursière de la R. Howard Webster Foundation de l'Institut canadien de recherches avancées, et membre de la Société royale du Canada. En 2010, elle est accueillie comme membre de la Royal Society of London et elle est élue à la National Academy of Sciences des É.-U. et, en 2015, est accueillie à titre de membre de l'American Academy of Arts and Sciences.

PhD Physics Degrees Awarded in Canadian Universities*
Doctorats en physique décernés par les universités canadiennes*

December 2014 to december 2015 / Décembre 2014 à décembre 2015

École Polytechnique de Montréal

BENGUEDOUAR, T., "Étude du couplage entre les codes Tripoli et Dragon", (G. Marleau), August 2015, maintenant un Coordinateur et chargé de cours à Polytechnique Montréal, Montréal, QC, Canada.

CHOUBAK, S., "The Impact of Hydrogen and Oxidizing Impurities in Chemical Vapor Deposition of Graphene on Copper", (P. Desjardins/ R. Martel), April 2015, now searching for employment in the United States.

DION, M., "Développement de méthodes de calcul de coefficients de sensibilité des sections efficaces multigroupes autoprotégés et de sensibilité implicite du K_{eff} aux densités isotopiques", (G. Marleau), March 2015, now pursuing a Post Doctoral Fellowship at the Canadian Nuclear Laboratory, Chalk River, ON, Canada.

GAGNÉ, M., "Fabrication et applications des réseaux de Bragg ultra-longs", (R. Kashyap), July 2015, maintenant un Ingénieur optique à ESI - Pyrophotonics Lasers, Montréal, QC, Canada.

HARRISSON, G., "Prise en compte des profls de conditions des matériaux et du couplage axial le long d'un canal du réacteur refroidi à eau supercritique canadien", (G. Marleau), February 2015, now pursuing a Post Doctoral Fellowship at the Canadian Nuclear Laboratory, Chalk River, ON, Canada.

MARKOV, A., "Practical Microstructures and Plasmonic Terahertz Waveguides", (M.A. Skorobogatiy), May 2015, now pursuing a Post Doctoral Fellowship at the Institut National de la Recherche Scientifique (INRS), Varennes, QC, Canada.

POULIN, J., "Toward Cold Atom Guidance in a Hollow-Core Photonic Cristal Fibre Using a Blue Detuned Hollow Laser Beam", (R. Kashyap and A.N. Luiten), September 2015, now a R&D Optolectronic Leader at The Luminaires Group, Montreal, QC, Canada.

QIAN, J., "Tribo-Mechanical and Electronic Properties of Boron-Containing Coatings", (J.-E. Sapieha, W. Zhang and L. Martinu), March 2015, now pursuing a Post Doctoral Fellowship at the Polytechnique Montreal, Montreal, QC, Canada.

*This list includes all information submitted to the CAP office by 2016 January 21.

**La liste comprend l'information reçue au bureau de l'ACP jusqu'au 21 janvier 2016.*

RIOUX, D., "Synthèse et modélisation des propriétés optiques de nanoparticules d'alliage or-argent et leur application en imagerie hyperstectrale", (M. Meunier), August 2015, now pursing a Post Doctoral Fellowship at Polytechnique Montréal, Montreal, QC, Canada.

SAYAGO HOYOS, J. J., "Organic Transistors Making Use of Room Temperature Ionic Liquids as Gating Medium", (C. Santato, F. Cicoira and F. Saovi), August 2015, now pursing a Post Doctoral Fellowship at the Univesidat Nacional Autonoma de Mexico, Mexico city Distrito Federal, Mexico.

SIMONEAU, L.-P., "Percolation dans des réseaux réalistes de nanostructures de carbone", (A. Rochefort), August 2015, maintenant un membre du personnel technique, MDA Corporation, St-Anne-de-Bellevue, QC, Canada.

SOARES DE LIMA FILHO, E., "Theoretical and Experimental Studies of Laser Induced Cooling of Solids", (R. Kashyap), May 2015, now pursing a Post Doctoral Fellowship at the Centre d'Optique, photonique et lasers (COPL), Université Laval, Quebec, QC, Canada.

VANIER, F., "Nonlinear Optics in Chalcogenide and Tellurite Microspheres for the Generation of Mid-Infrared Frequencies", (Y.-A. Peter and M. Rochette), December 2015, now searching for employment in Canada.

VERNHES, L., "Thin Coatings for Heavy Industry: Advanced Coatings for Pipes and Valves", (J.-E. Sapieha and L. Martinu), February 2015, now a Corporate Manager of Product Innovation and Technology at Velan, Montreal, QC, Canada.

McMaster University

FU, M., "Revealing the Ground State Properties of the S = 1/2 Kagome Heisenberg Antiferromagnet:170 Single-Crystal NMR Investigations of ZnCu3(OH)6Cl2", (T. Imai), October 2015, now a Post-Doc at the John Hopkins University & NIST, Baltimore/Gaithersburg, MD, United States of America.

HALL, J., "Hybridization, hidden order, and antiferromagnetism in URu2Si2: electrodynamics studied by infrared spectroscopy", (T. Timusk), September 2015, now a Research Assistant at McMaster University in the Department of Physics & Astronomy, Hamilton, ON, Canada.

ILTON, M., "Flow in Thin Polymer Films", (K. Dalnoki-Veress), December 2015, now a Post-Doc at the University of Massachusetts at Amherst, Amherst, MA, United States of America.

JACKEL, B., "Magnetic Dynamos: How Do They Even Work?", (E. Vishniac), September 2015, now a Machine Learning Research Scientist at the Makeplain Corporation, Toronto, ON, Canada.

NG, R., "Non-equilibrium real time dynamics of quantum spin systems and the quantum critical dynamics of 'dirty' bosons", (E. Sorensen), July 2015, now searching for employment.

SCHIRM, M., "Molecular Gas in Nearby Merging and Interacting Galaxies: the Whirlpool Galaxy (M51) and the Antennae Galaxies (NGC 4038/39)", (C. Wilson), September 2015, now a Data Analyst at EA, Kitchener, ON, Canada.

SLIWA, K., "Molecular Gas Properties of Local Luminous Infrared Galaxies", (C. Wilson), July 2015, now a Post-Doc at the Max-Planck Institute for Astronomy, Heidelberg, Germany.

SUR, S., "Low Energy Effective Field Theories for Metallic Quantum Critical Points", (S. Lee), August 2015, now a Post-Doc at the Florida State University, Tallahassee, Florida, United States of America.

TOPPOZINI, L., "Effects of various molecules on the structure and dynamics of lipid membranes", (M. Rheinstadter), September 2015, now searching for employment.

WAGMAN, J., "Neutron Scattering Studies of Strong Dynamic Correlations in High Temperature Superconductors", (B. Gaulin), August 2015, now searching for employment.

WARD, R., "The Structure and Evolution of Unbound Star-forming Molecular Clouds", (A. Sills and J. Wadsley), July 2015, now a Researcher/Programmer in Astronomy & Space Sciences at the Ontario Science Centre, Toronto, ON, Canada.

WEBB, J., "The Scale Size and Dynamical Evolution of Star Clusters in Tidal Fields", (W. Harris and A. Sills), July 2015, now a Post-Doc at the Indiana University Bloomington, Bloomington, IN, United States of America.

WOODS, R., "A New Approach to Radiative Transfer in Galaxies", (H. Couchman and J. Wadsley), September 2015, now a Data Scientist at Preteckt, Memphis, Tennessee, United States of America.

Memorial University

MA, Z., "Simulation of Wind Forced Responses over the Newfoundland Shelf", (G. Han and B. de Young), October 2015, now a Postdoctoral Fellow at the Northwest Atlantic Fisheries Centre, Fisheries & Oceans, St. John's, NL, Canada.

XU, B., "Assessing Different Types of Disorder in Carbonate Minerals with Vibrational Spectroscopy", (K. Poduska), October 2015, now a Postdoctoral Fellow in the Department of Science at the China University of Petroleum, Huadong, China.

Université de Montréal

ANTONIUS, G., "Calculs ab initio de structures électroniques et de leur dépendance en température avec la méthode GW", (M. Côté), Février 2015.

BOLDUC, C., "Modélisation de l'irradiance solaire totale et spectrale et applications à la chimie stratosphérique terrestre", (P. Charbonneau et M. Bourqui), Avril 2015.

COSSETTE, J., "Simulations magnétohydrodynamiques en régime idéal", (P. Bergeron et P. K. Smolarkiewicz), Février 2015.

DAWOOD, M., "Space and Time Characterization of Laser-Induced Plasmas for Applications in Chemical Analysis and Thin Film Deposition", (J. Margot), Septembre 2015.

DÉSILETS-BENOIT, A., "Étude du champ magnétique interne de deux matériaux magnétiques et d'un supraconducteur sans symétrie d'inversion", (A. Bianchi), Février 2015.

GAGNÉ, J., "La recherche de naines brunes et étoiles de faible masse dans les associations cinématiques jeunes du voisinage solaire", (R. Doyon et D. Lafrenière), Septembre 2015.

GENEST, V., "Structures algébriques, systèmes superintégrables et polynômes orthogonaux", (L. Vinet), Septembre 2015.

KAM, S.Z., "Étude de la cinématique HI (21cm) et H-Alpha de la galaxie du Triangle (M33)", (C. Carignan), Septembre 2015.

LIMOGES, M.M., "Relevé spectroscopique et étude des propriétés physiques des étoiles naines blanches à moins de 40 parsecs du Soleil", (P. Bergeron et S. Lepine), Février 2015.

MAALOUL, L., "Dynamique de croissance par plasma RF magnétron des couches minces à base d'oxyde de zinc", (L. Stafford), Septembre 2015.

MALO, L., "Recherche et caractérisation des étoiles jeunes de faible masse dans le voisinage solaire", (R. Doyon), Février 2015.

MCGUIRE, H., "Étude de l'oligomérisation et de la fonction de canaux ioniques par spectroscopie de fluorescence et fluorométrie en voltage imposé", (R. Blunck), Février 2015.

MULLER, R., "Topological order in a broken-symmetry state", (A. Bianchi), Septembre 2015.

NASSIRI, M.A., "Les algorithmes de haute résolution en tomographie d'émission par positrons: développement et accélération sur les cartes graphiques", (C. Leroy et P. Després), Septembre 2015.

OWERRE, S.A., "Études de l'effet tunnel des spins quantiques macroscopiques", (M. Paranjape), Février 2015.

PAQUIN, F., "Effet de la microstructure sur les propriétés excitoniques des polymères semi-conducteurs semi-cristallins", (C. Silva), Février 2015.

Université de Sherbrooke

DUCLOS-CIANCI, G., « Outils de calcul quantique tolérant aux fautes », (D. Poulin), Avril 2015, maintenant un Assistant de recherche à l'École polytechnique de Montréal, et un scientifique chez Anyon Systems Inc., Montréal, Québec, Canada.

FAYE, J.P.L., « Méthodes d'amas quantiques dans l'étude des modèles de Hubbard », (D. Sénéchal), Juillet 2015, maintenant un Stagiaire postdoctoral dans le département de physique, Université de Sherbrooke, Sherbrooke, QC, Canada.

LALUMIÈRE, K., « Électrodynamique quantique en guide d'onde », (A. Blais), Juillet 2015, maintenant un Scientifique chez Anyon Systèmes Inc, Montréal, QC, Canada.

MANSOURI, S., « Étude magnéto-optique des composés multiferroïques: DyMnO_3 et TbMn_2O_5 », (S. Jandl), Février 2015, maintenant un Stagiaire postdoctoral dans le département de physique, Université de Sherbrooke, Sherbrooke QC, Canada.

VERMETTE, J., « Origine de l'effet magnétoélectrique dans les manganites de structure hexagonale », (S. Jandl), Avril 2015, maintenant Professionnel de recherche dans le département de chimie, Université de Sherbrooke, Sherbrooke, QC, Canada.

University of Manitoba

HILDEBRAND, W.K., "Ultrasonic Waves in Strongly Scattering Disordered Media: Understanding Complex Systems through Statistics and Correlations of Multiply Scattered Acoustic and Elastic Waves", (J.H. Page), October 2015.

KIDWAI, S., "Electron Impact Excitation Studies of Laser-Excited and Ground-State Barium and Ytterbium", (G. Gwinner), October 2015, Searching for Employment.

MACEWAN, S., "The Weak Charge of the Proton: A Search for Physics Beyond the Standard Model", (M. Gericke), October 2015.

MATHESON, H., "X-Ray Observations of the Young Pulsar Wind Nebula G21.5-0.9 and the Evolved Pulsar Wind Nebuae CTB 87 (G74.9 + 1.2) and G63.7 + 1.1", (S. Safi-Harb), February 2015, Searching for Employment.

University of New Brunswick

ARBABI, A., "Magnetic Resonance Study of Two-Phase flows: Acoustic Cavitations and Vertical Bubbly Flows", (Igor Mastikhin), May 2015, now pursuing a Postdoctoral Fellowship at the University for Sick Children, Toronto, ON, Canada.

LANGILLE, J., "The Development and Optimization of Two High-Resolution Interferometers for the Measurement of Upper Atmospheric Winds", (William Ward), October 2015, now pursuing a Postdoctoral Fellowship at the University of New Brunswick, Fredericton, NB, Canada.

VASHAEE, S., "Quantitative Magnetic Resonance Measurements of Porous Media: Radio Frequency Field Mapping and Selectibe Pulse Design", (Bruce Balcom), May 2015, now pursuing a Postdoctoral Fellowship at the University of New Brunswick, Fredericton, NB, Canada.

WATSON, C., "GPS Total Electron Content Techniques for Observing the Structure and Dynamics of the High Latitude Ionosphere", (P.T. Jayachandran), May 2016, now pursuing a Postdoctoral Fellowship at the University of Calgary, Calgary, AB, Canada.

University of Ottawa

BARLOW, A., "Coherent anti-stokes Raman Scattering Microscopy", (A. Stolow), April 2015.

HAASE, K., "Mechanics & Mechanotransduction of Adherent Cells A Compendium of Atomic Force Microscopy Studies", (A. Pelling), December 2014, following an NSERC Postdoctoral Fellowship at MIT.

KWOK, H.W.H., "New Approach in Fabrication of Solid-State Nanopore for Bio-Sensing Applications", (V. Tabard-Cossa), February 2015.

LI-POOK-THAN, A., "In Situ Raman Spectroscopy of the Type Selective Etching of Carbon Nanotubes and their Growth from C60 Seeds", (P. Finnie), August 2015.

LU, Y., "Study of Kerr phase-interrogator and the applications", (X. Bao), November 2015, now an Assistant Professor at the Chinese Defense University in Changsha, China.

OZFIDAN, I., "Electron-Electron Interactions in Optical Properties of Graphene Quantum Dots", (P. Hawrylak), August 2015, now following a Post Doctoral Fellowship at the University of Alberta, Edmonton, AB, Canada.

THÉRIAULT, O., "Analysis of the external quantum efficiency of quantum dot enhanced multi-junction solar cells", (K. Hinzer), December 2014.

University of Saskatchewan

BAZYLEWSKI, P., "Band Engineering of Graphene using Metal Mediated Oxidation", (G.S. Chang), May 2015, now pursuing a Post Doctoral Fellowship at the University of Western Ontario, London, ON, Canada.

BERTWISTLE, D., "X-Ray Crystallography of Inositol Dehydration Enzymes", (J. Bergstrom and D. Sanders), April 2015, now working in the Accelerator Operations and Development department of Canadian Light Source, Saskatoon, SK, Canada.

PERRY, G., "Large Scale Plasma Density Pertubations in the Polar F-Region Ionosphere", (J.P. St-Maurice), February 2015, now an Eyes High Post Doc at the University of Calgary, Calgary, AB, Canada.

PURDY, S., "Carbon Ion Implanted Silicon for Schottky Light-Emitting Diodes", (G.S. Chang and M. Bradley), October 2015, now a physicist at Blue Sky Spectroscopy, Lethbridge, AB, Canada.

ZARIFI, N., "Computational approaches and structural prediction of high pressure molecular solids", (J. Tse), August 2015, now currently unemployed and will start a Post Doctoral Fellowship in the Department of Chemistry in June 2016 at the University of Buffalo, Buffalo, NY, United States of America.

UNIVERSITY OF TORONTO

ABOUZEID, O.S.A., "The search for a heavy-like boson in the H-WW-lvjj channel with the ATLAS detector", (P. Krieger), November 2015, now following a Post Doctoral Fellowship at the University of California in Santa Cruz (UCSC), based at CERN, Geneva, Switzerland.

BENTON, S.J., "Mapping submillimetre polarization with BLASTPol", (C. B. Netterfield), June 2015, now following a Post Doctoral Fellowship, Cosmology, Princeton University, New Jersey, NJ, United States of America.

BRADEN, J.N., "Nonlinear intermittent field dynamics in the early universe", (J.R. Bond), June 2015, now following a Post Doctoral Fellowship at the University College London, London, United Kingdom.

BURENKOV, V.V., "Security issues of quantum cryptographic systems with imperfect detectors", (H.-K. Lo), June 2015, now following a Post Doctoral Fellowship at the University of York, York, United Kingdom.

CHAN, I., "Balance models for equatorial planetary-scale dynamics", (T.G. Shepherd), June 2015, now a Quantitative Analyst at FinCAE, financial tech Co, Vancouver, BC, Canada.

ERLER, A.R., "High resolution hydro-climatological projections for Western Canada", (W.R. Peltier), November 2015, now a Postdoctoral Scientist, Aquanty, Waterloo, ON, Canada.

FEIZPOUR, A, "Nonlinear optics at the single-photon level", (A.M. Steinberg), March 2015, now following a Post Doctoral Fellowship in the Department of Physics at Oxford University, Oxford, United Kingdom.

FREEDMAN, S., "Applications of effective field theory techniques to jet Physics", (M.E. Luke), June 2015, now a Quantitative Analyst at the Canadian International Bank of Commerce, Toronto (CIBC), ON, Canada.

GHOFRANI TABARI, M., "Time-lapse ultrasonic imaging of elastic anisotropy in saturated sandstone under polyaxial stress state", (R.P. Young), November 2015, now following a Post Doctoral Fellowship in Civil Engineering at the University of Toronto, Toronto, ON, Canada

GOMEZ SANCHEZ, C., "Topics in Physics beyond the standard model with strong interactions", (B. Holdom), November 2015, searching for employment.

ILIC, N., "The discovery of the Higgs Boson on the WW→ 1v1v decay mode", (R.J. Teuscher), June 2015, now following a Post Doctoral Fellowship at Stanford University based at CERN in Geneva, Switzerland.

LEE, K., "Theoretical progress in hyper honeycomb iridate b - Li2IrO3", (Y.-B. Kim), November 2015, now employed by DeepLearning4j, Toronto, ON, Canada.

LUPASCU, A., "Magnetic and structural properties of iridates and cuprates in reduced dimensions", (Y.-J. Kim), November 2015, now employed in the private sector financial field.

MAHLER, D.H., "Quantum measurement on a budget", (A.M. Steinberg), June 2015, now a Research Assistant at the Centre for Quantum Photonics at Bristol University, Bristol, United Kingdom.

O'KEEFFE, D.K., "Aspects of applied holography", (A. Peet), November 2015, now employed in the financial sector.

QIAN, Z., "A study of burst-mode ultrafast-pulse laser ablation on soft tissues and tissue-proxies", (R.S. Marjoribanks), November 2015, searching for employment.

QUESADA MEJIA, J.N., "Very nonlinear quantum optics", (D.F.V. James), November 2015, now following a Post Doctoral Fellowship at Sherbrooke University, Sherbrooke, QC, Canada.

RAO, K.M., "Photocurrent control in a magnetic field through quantum interference", (J.E. Sipe), June 2015, now searching for employment.

RYAN, N., "The application of millimeter wave spectroscopy to ground-based remote sensing of the atmosphere", (K.A. Walker), June 2015, now searching for employment.

SAMIM, M., "Nonlinear Polari metric microscopy for biomedical imaging", (V. Barzda), November 2015, now following a Post Doctoral Fellowship at the University Health Network, Toronto, ON, Canada.

SCHRAMM, S., "Search for dark matter with the ATLAS detector in events with an energetic jet and large missing transverse momentum", (P.E. Savard), June 2015, now following a Post Doctoral Fellowship at the University of Geneva, Geneva, Switzerland.

SMYTH, C., "Measuring quantum effects in photosynthetic light-harvesting complexes with multipartite entanglement", (G.D. Scholes), June 2015, now following a Post Doctoral Fellowship at Fields Institute in the University of Toronto, Toronto, ON, Canada.

SUN, D., "The effect of hydrostatic pressure on the nematic phases of Sr3Ru2O7", (S.R. Julian), June 2015, now following a Post Doctoral Fellowship at Max Planck Institute for Chemical Physics of Solids, Dresden, Germany.

TEEPLE, B.J., "Deconfinement and duality of (super) Yang-Mills on toroidially compactified space times for all gauge groups, (E. Poppitz), November 2015, now searching for employment.

TIAN, Y., "Planetary dynamos: magnetic constraints on the interior structure and evolution of a planet", (S. Stanley), November 2015, now pursuing a degree in finance.

VILIM, R., "The effect of material properties on dynamo generation in planets", (S. Stanley), November 2015, now a Data Scientist at Axon Vibe, New York, NY, U.S.A.

ZAREAPOUR, P, "Proximity effect and tunnelling spectroscopy of high-temperature superconductor-semiconductor hybrid structures", (K.S. Burch), November 2015, now an Associate Technical Consultant at SWI System ware Innovation Corporation, Toronto, ON, Canada.

UNIVERSITY OF WESTERN ONTARIO

AHMED, M.H.A., "Nitrogen Abundances in Early-Type Be Stars", (T.A.A. Sigut), October 2015, currently pursuing a post-doctoral fellowship in Canada or elsewhere.

GARBANZO SALAS, M., "High resolution tropospheric studies with a MST type radar", (W.K. Hocking), October 2015, now a full-time Instructor at the University of Costa Rica.

GOLRIZ, S., "Stellar Spectroscopy: New Methods and Insights", (J. Cami and J. Landstreet), April 2015, currently pursuing employment.

HAQUE, I., "The study of Stark effect and proton trapping in photonic crystals", (M.R. Singh), January 2015, now a Math Technologist at Fanshawe College's Learning Centre.

JONES, S., "Methods and results toward measuring magnetic field in star-forming regions", (M. Houde), April 2015, now a part-time research technologist at the University of Waterloo.

LOBACHEVA, O., "Ion beam modification of strontium titanate and highly oriented pyrolytic graphite", (L. Goncharova and T.K. Sham), May 2015, now pursuing employment.

McCULLOUGH, E., "A new technique for interpreting depolarization measurements using the CRL atmospheric lidar in the Canadian High Arctic", (R.J. Sica), December 2015, now working on Lidar equipment in the Canadian High Arctic.

UNIVERSITY OF WINDSOR

McKENZIE, C., "An Interpretation of Relativistic Spin Entanglement Using Geometric Algebra", (William Baylis), October 2015, now a Teaching Assistant at the University of Windsor and searching for employment.

YORK UNIVERSITY

SEABROOK J., "Differential Absorption Lidar Measurements of Tropospheric Ozone in the Artic", (J. Whiteway), June 2015, now a Postdoctoral Fellow at York University, Toronto, ON, Canada.

The list of PhD Degrees awarded in the following universities will be included in the next issue (No. 2) :

La liste des doctorats décernés par les universités suivantes sera incluse dans le prochain numéro (no. 2) :

Brock University, Carleton University, McGill University, Queen's University, Simon Fraser University, University of Alberta, and/et University of Victoria

BOOK REVIEW POLICY

Books may be requested from the Book Review Editor, Richard Marchand, by using the online book request form at http://www.cap.ca (Publications).

CAP members are given the first opportunity to request books. For non-members, only those residing in Canada may request a book. Requests from non-members will only be considered one month after the distribution date of the issue of *Physics in Canada* in which the book was published as being available.

The Book Review Editor reserves the right to limit the number of books provided to reviewers each year. He also reserves the right to modify any submitted review for style and clarity. When rewording is required, the Book Review Editor will endeavour to preserve the intended meaning and, in so doing, may find it necessary to consult the reviewer. Reviewers submit a 300–500 word review for publication in *PiC* and posting on the website; however, they can choose to submit a longer review for the website together with the shorter one for *PiC*.

LA POLITIQUE POUR LA CRITIQUE DE LIVRES

Si vous voulez faire l'évaluation critique d'un ouvrage, veuillez entrer en contact avec le responsable de la critique de livres, Richard Marchand, en utilisant le formulaire de demande électronique à http://www.cap.ca (Publications).

Les membres de l'ACP auront priorité pour les demandes de livres. Ceux qui ne sont pas membres et qui résident au Canada peuvent faire une demande de livres. Les demandes des non-membres ne seront examinées qu'un mois après la date de distribution du numéro de la Physique au Canada dans lequel le livre aura été déclaré disponible.

Le Directeur de la critique de livres se réserve le droit de limiter le nombre de livres confiés chaque année aux examinateurs. Il se réserve, en outre, le droit de modifier toute critique présentée afin d'en améliorer le style et la clarté. S'il lui faut reformuler une critique, il s'efforcera de conserver le sens voulu par l'auteur de la critique et, à cette fin, il pourra juger nécessaire de le consulter. Les critiques pour publication dans la PaC doivent être de 300 à 500 mots. Ces critiques seront aussi affichées sur le web ; s'ils le désirent les examinateurs peuvent soumettre une plus longue version pour le web.

BOOKS RECEIVED / *LIVRES REÇUS*

The following titles are a sampling of books that have recently been received for review. Readers are invited to write reviews, in English or French, of books of interest to them. Unless otherwise indicated, all prices are in Canadian dollars.

Lists of all books available for review, books out for review and book reviews published since 2000 are available on-line at www.cap.ca (Publications).

In addition to books listed here, readers are invited to consider writing reviews of recent publications, or comparative reviews on books in topics of interest to the physics community. This could include for example, books used for teaching and learning physics, or technical references aimed at professional researchers.

Les titres suivants sont une sélection des livres reçus récemment aux fins de critique. Nous invitons nos lecteurs à nous soumettre une critique en anglais ou en français, sur les sujets de leur choix. Sauf indication contraire, tous les prix sont en dollars canadiens.

Les listes de tous les livres disponibles pour critique, ceux en voie de révision, ainsi que des critiques publiées depuis 2000 sont disponibles sur : www.cap.ca (Publications).

En plus des titres mentionnés ci-dessous et sur le site web de l'ACP, les lecteurs sont invités à soumettre des revues sur des ouvrages récents, ou des revues thématiques comparées sur des sujets particuliers. Celles-ci pourraient par exemple porter sur des ouvrages de nature pédagogique, ou des textes de référence destinés à des professionnels.

GENERAL INTEREST

ECOLOGICAL MECHANICS: PRINCIPLES OF LIFE'S PHYSICAL INTERACTIONS, Mark Denny, Princeton University Press, 2015; pp. 536; ISBN: 9781400873951; Price: 99.95.

SEARCHING FOR THE OLDEST STARS: ANCIENT RELICS FROM THE EARLY UNIVERSE, Anna Frebel, Princeton University Press, 2015; pp. 320; ISBN: 9781400874286; Price: 29.17.

THE PLANET REMADE: HOW GEOENGINEERING COULD CHANGE THE WORLD, Oliver Morton, Princeton University Press, 2015; pp. 440; ISBN: 9781400874453; Price: 37.95.

UNDERGRADUATE TEXTS

BIOLOGICAL MATERIALS SCIENCE: BIOLOGICAL MATERIALS, BIOINSPIRED MATERIALS, AND BIOMATERIALS, Marc André Meyers, Po-Yu Chen, Cambridge University Press, 2014; pp. 644; ISBN: 978-1107010451; Price: 103.95.

ELEMENTS OF SLOW-NEUTRON SCATTERING: BASICS, TECHNIQUES, AND APPLICATIONS, J.M. Carpenter and C.-K. Loong, Cambridge University Press, 2015; pp. 536; ISBN: 978-0521857819; Price: 200.95.

HOW DO YOU FIND AN EXOPLANET?, John Asher Johnson, Princeton University Press, 2015; pp. 200; ISBN: 9781400873999; Price: 43.95.

MOLECULAR ENGINEERING THERMODYNAMICS, Juan J. de Pablo and Jay D. Schieber, Cambridge University Press, 2014; pp. 501; ISBN: 978-0521765626; Price: 100.29.

GRADUATE TEXTS AND PROCEEDINGS

ENERGY LANDSCAPES, INHERENT STRUCTURES AND CONDENSED-MATTER PHENOMENA, Frank H. Stillinger, Princeton University Press, 2015; pp. 528; ISBN: 978-0691166803; Price: 125.00.

Book Reviews / *Critiques de livres*

Book reviews for the following books have been received and posted to the *Physics in Canada* section of the CAP's website: http://www.cap.ca. When available, the url to longer versions are listed with the book details.

Des revues critiques ont été reçues pour les livres suivants et ont été affichées dans la section "La Physique au Canada" de la page web de l'ACP: http://www.cap.ca. Quand disponible, un lien url à une critique plus longue est indiqué avec les détails du livre.

Sea-Level Science: Understanding Tides, Surges, Tsunamis and Mean Sea-Level Changes by David Pugh and Philip Woodworth, Cambridge University Press, 2014, pp: 395, ISBN: 978-1-107-02819-7, price 131.95.

Ce livre est un compte rendu du niveau de la mer et des raisons physique par lesquels il change, comme les marées, les effets météorologiques, les tsunamis, les changements climatiques à long terme et les changements dus á la croûte terrestre. Ce volume couvre plusieurs champs d'étude comme l'océanographie, la géologie, la géodésie, les changements climatiques, le génie côtier, la gestion des données et plus encore.

Les auteurs introduisent le sujet par une brève discussion sur les changements du niveau de la mer causés par les marées, les ondes de tempêtes et les tsunamis. Ils présentent des exemples de différentes manifestations du changement de niveau de la mer causé par la marée à différents endroits dans le monde. L'introduction (chapitre 1) se termine avec des notions de statistique de base et un modèle conceptuel espace-temps des différents processus pouvant causer ces changements.

Le chapitre suivant présente un sommaire des méthodes de mesure du niveau de la mer lors des cycles de marée. De là on y discute des structures, des appareils de mesures, ainsi que de la transmission, du stockage, des procédures de vérification et de l'accès aux données.

Les chapitres 3 et 4 forment un ensemble incontournable sur le thème des forces et de l'analyse de marée. La description des forces de marée débute avec la notion d'attraction gravitationnelle et le développement du concept de marée d'équilibre du système terre-lune-soleil. Cela fait intervenir par la suite l'identification des fréquences astronomiques et la description des modèles de marée incluant cette fois leurs variations à plus long terme. Le développement de la notion de marée d'équilibre nous conduit alors à l'analyse harmonique dans laquelle les variations du niveau de la mer par la marée peuvent être représentées par un nombre fini d'harmonique de forme sinusoïdale incluant une amplitude et une phase par rapport à la marée d'équilibre. On retrouve tout le développement théorique de la méthode de l'analyse harmonique nécessaire pour apprécier un logiciel de prévision de marées tel T_TIDE (*Classical tidal harmonic analysis including error estimates in MATLAB using T_TIDE*; de Rich Pawlowicz, Bob Beardsley, Steve Lentz; Computers & Geosciences 28 (2002) 929–937).

La discussion porte ensuite sur les ondes océaniques longues excitées par les forces de marée responsables du transfert d'énergie autour de la Terre, et sur la façon dont elles interagissent et forment un profil différent de celui de la marée d'équilibre. On explique aussi le fait que de l'océan, les ondes de marée font leur transition vers les eaux peu profondes des plateaux continentaux. Interviennent donc par la suite les estuaires et les rivières, où dans ce cas, les ondes de marée subissent de plus fortes distorsions de par le fait du changement de bathymétrie et des interactions non-linéaires. Dans ce contexte *le modèle NS_TIDE est un ajout au modèle déjà mentionné, qui permet cette fois une représentation harmonique non-stationnaire de la marée et permet d'exprimer la réponse de la marée aux forçages du débit fluvial et de la marée océanique. On consultera par exemple l'article de Matte P, Secretan Y & Morin J (2014) Temporal and spatial variability of tidal-fluvial dynamics in the St. Lawrence fluvial estuary: An application of nonstationary tidal harmonic analysis. (J. Geophys. Res 119: 5724–5744.)*

L'augmentation extrême du niveau de la mer par les ondes de tempête (généré par la pression atmosphérique et le vent) ainsi que les tsunamis (généré par une déstabilisation du fond sous-marin) à travers le monde sont traités dans les chapitres 7 et 8. Les auteurs nous inicient aussi aux météostunamis, qui s'apparentent aux tsunamis de par leur oscillation du niveau de la mer observé à la jauge de marée, mais qui contrairement à une origine sismique, sont créés par le transport d'ondes atmosphériques en résonance avec les longues ondes océaniques. *On pourra se référer particulièrement à l'article Meteorological tsunamis on the coast of British Columbia and Washington, de R.E. Thomson, A.B. Rabinovich, I.V. Fine, D.C. Sinnott, A. McCarthy, N.A.S. Sutherland, L.K. Neil, Physics and Chemistry of the Earth, 34 (2009) 971–988. Je mentionne aussi l'article intéressant suivant sur le plus important tsunami ayant eu lieu au Canada: The Grand Banks landslide-generated tsunami of November 18, 1929: preliminary analysis and numerical modeling, de I.V. Fine, A.B. Rabinovich, B.D. Bornhold, R.E. Thomson, E.A. Kulikov, Marine Geology, 215 (2005) 45–57.*

Les satellites ont révolutionné notre approche et compréhension des changements du niveau de la mer, et leurs variations spatiales. Le chapitre 9 porte sur la mesure du niveau des océans par les satellites altimétriques, la mesure satellitaire du champ gravitationnel de la Terre et enfin la détermination du géoïde. Cela a permis de dériver, par exemple, la circulation de surface du gyre subpolaire Nord-Atlantique et d'en comparer les résultats avec des mesures océanographiques. Le chapitre suivant présente l'importance du changement du niveau de la mer au cours du temps, tant sur la variabilité interannuelle que saisonnière. Les auteurs présentent des projections pour le 21^{ieme} siècle basées sur une possible fonte glacielle ou l'expansion thermique de la mer due au réchauffement climatique.

Le chapitre 11 introduit les techniques de mesure du mouvement vertical de la lithosphère et les facteurs qui en sont la cause, comme les changement passés et présents de la distribution de la glace et de l'eau. Le mouvement de la croûte terrestre est relatif au géoïde ou au niveau moyen de la mer, alors que le mouvement isostatique est référé à la position et la hauteur de la mer par rapport à la terre. *Voir par exemple Pattern of recent vertical crustal movements in Canada, de A. Koohzare, P. Vanicek, M. Santos, Journal of geodynamics, 45 (2008), 133–145.* Les deux derniers chapitres considèrent d'abord les problèmes d'ingénierie de la gestion des régions côtières, de leur protection et des problèmes économiques qui leurs sont reliés. On y considère ensuite l'impact de la variation du niveau de la mer sur les écosystèmes côtiers et les humains.

En résumé, volume très bien documenté, parfaitement référencé et clairement illustré. Il fait suite à un ouvrage paru en 1987, qui a été remis à jour suite aux nouveaux développements qui sont survenus depuis. Les appendices présentent un résumé mathématique des notions d'hydrodynamique présentées au cours des chapitres. Ce volume permet une mise à niveau sur le sujet et il sera utile aux étudiants de niveaux supérieurs, chercheurs, décideurs gouvernementaux, et ingénieurs côtiers.

André April.
Prévisionniste au Service Météorologique du Canada.
Ottawa, ON

Physics in Canada
La Physique au Canada

To Come / *À venir*

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No.2 Applied Magnetism /
Le magnétisme appliqué

No.3 Physics Outreach /
Engagement communautaire de la physique

No.4 Post-Congress / *Après-congrès*

The Editorial Board welcomes articles from readers suitable for, and understandable to, any practising or student physicist. Review papers and contributions of general interest of up to four journal pages in length are particularly welcome. Suggestions for theme topics and guest editors are also welcome and should be sent to bjoos@uottawa.ca.

Le comité de rédaction invite les lecteurs à soumettre des articles qui intéresseraient et seraient compris par tout physicien, ou physicienne, et étudiant ou étudiante en physique. Les articles de synthèse d'une longueur d'au plus quatre pages de revue sont en particulier bienvenus. Des suggestions de sujets pour des revues à thème sont aussi bienvenues et pourront être envoyées à bjoos@uottawa.ca.

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