University of Regina

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Dr. Thomas Chase
Provost and Vice President (Academic)
University of Regina

January 25, 2016

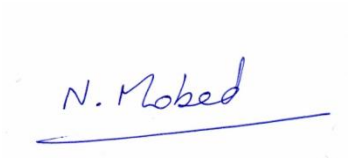
Dear Dr. Chase,

The Self-Study document for the upcoming Academic Unit Review of the Physics Department is attached to this letter.

The following steps were taken to produce the Self-Study.

- A Steering Committee for the unit review process was formed in July 2015 by seeking nominations, including self-nominations, from the Department. Based on the input received, the Committee membership consists of: G. Huber, G. Lolos, N. Mobed, Z. Papandreou.
- The Committee, in consultations with the Department, met periodically from October through December 2015.
- The first draft of the Self-Study was released to the Department on December 15, 2015.
- Based on the feedback received, the second draft of the Self-Study was released to the Department on January 12, 2016.
- A Departmental meeting was held on January 15, 2016, to discuss the final version of the Self-Study. After some discussion, the Department endorsed the Self-Study.

Sincerely,



Nader Mobed
Professor and Head
Department of Physics

University of Regina

DEPARTMENT OF PHYSICS

ACADEMIC UNIT REVIEW SELF STUDY REPORT

2015 – 2016

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University of Regina

DEPARTMENT OF PHYSICS

ACADEMIC UNIT REVIEW SELF STUDY REPORT
2015-2016

1. BACKGROUND

The Department's efforts are based on teaching and research, as expected from a university department. It became clear in the early 80's that the department would never be large enough to sustain a cutting edge and competitive research program in a more than a couple of research areas. As such, the decision was made then – and endorsed by the last Academic Unit review in 1996 – to concentrate resources in the field of subatomic physics (SAP) with experimental and theoretical components. This is the direction the Department has followed. As a result of this focusing of efforts, the environment in the Department is highly collaborative, with close interaction between the different research groups in terms of sharing resources and providing peer-instruction to grad students. This allowed a critical mass of research effort in a small department, and considerable successes in terms of external grant awards, highly cited publications and Ph.D. degrees awarded.

Over the past decade, the two largest research contributions of the Department were concentrated on experimental efforts connected to TRIUMF (Barbi, Mathie, Tacik) and Jefferson Lab (Huber, Lolos, Papandreou). Utilizing our local infrastructure and student talent, these groups contributed hardware to the respective experiments (T2K Fine-Grained Detector (FGD), GlueX Barrel Calorimeter (BCAL), SHMS Heavy Gas Cherenkov (HGC)). Graduate students received their degrees on these projects and contributions were made to the scientific output of the respective collaborations. In addition, there were contributions to the LHC program in terms of online analysis, simulations and phenomenology (Benslama, Kolev), and papers published in the fields of Chiral Perturbation Theory, Lattice QCD and General Relativity (Dutta, Lewis, Mobed, Ouimet).

Despite these successes, the Department has had setbacks over the past decade. Three research-focused faculty members (Benslama, Dutta, Lewis) left the Department. The commensurate loss to research productivity was not fully compensated for by the addition of two teaching-focused faculty (Kolev, Ouimet). Although the Department has a long history of research excellence in theoretical subatomic physics, this capacity has now nearly evaporated with the loss of Dutta's expertise in Super-Symmetry phenomenology, Lewis' expertise in Lattice QCD, and Mobed's significant time commitments as Associate Dean of Science. As a result, there was a significant loss of research and graduate instruction capacity whose negative effects we are still coping with today. Nevertheless, we have managed to keep a very active and highly regarded national and international research presence. This has been possible, in part, due to the fact that our faculty members have established collaborations in Canada, Japan, Germany and the U.S. We have played a leading role in several of these, and this continues to the present. We have also benefited from establishing strong associations with TRIUMF and Jefferson Lab.

Our Department offers programs leading to the B.Sc. and B.Sc. Honours degrees in Pure and Applied/ Industrial Physics, and the M.Sc. and Ph.D. degrees in Experimental and Theoretical Subatomic Physics. (We have stopped accepting students in theory until our complement of theorists is restored.) Co-operative Education programs with local industry play an important role in our undergraduate degree programs. There is also an adjunct faculty member at Campion College who conducts research in Observational Astronomy. Students working with him may obtain the M.Sc. degree in Physics. The Department owns the Astronomy domes, laboratory and equipment on the top floor of the Classroom Building. The Astronomy classes and labs have been offered by Campion College since 2007.

Our Department annually offers a large number of laboratory sections (~55 per year), primarily populated by students from service classes. We have two full-time instructors (Szymanksi, Tokaruk) that teach a number of labs, design and maintain experiments, and coordinate all laboratory operations. Graduate students (and a few undergraduate students) teach the bulk of the labs. This is a very cost-effective method of delivery for the university, and, more importantly, contributes significantly to the professional development of the teaching assistants.

Two of the last three faculty appointments in the Department were tenured lecturers (Ouimet, Kolev). These, together with a regular sessional (Fasunwon), teach most of the first-year service courses as well as a large compliment of upper-level courses, and this allows the Department to continue offering a B.Sc Honours and a graduate program.

Our Department has operated traditionally through standing and ad hoc committees: e.g., Curriculum Committee (Huber, Kolev, Lolos), Laboratory Committee (Barbi, Szymanski, Teymurazyan), Outreach, Recruitment and Retention Committee (Papandreou, Ouimet, Szymanski). Additionally, faculty undertake specific roles in governance (Liaison with Engineering, Webmaster) and in association with students (Co-op Coordinator, Undergraduate and Graduate Coordinators). We have also recently launched a number of outreach initiatives and activities.

The Canadian Association of Physicists 2014 Summary of Physics Departments[1] shows that the smallest department has 4 faculty members and the largest has 62, with 87% of faculty being research focused. Our corresponding numbers are 8 and 63%, respectively.

Glossary

BCAL — Barrel Calorimeter for the GlueX Experiment
Fedoruk — The Sylvia Fedoruk Canadian Centre for Nuclear Innovation
FGD — Fine Grained Detector for T2K
Fπ — Pion form factor experiment in Hall C, Jefferson Lab
GIFS — The Global Institute for Food Security, a University of Saskatchewan Institute
GlueX — Gluonic Excitations Experiment in Hall D, Jefferson Lab
HGC — Heavy Gas Cherenkov for the pion form factor experiments at Jefferson Lab
J-PARC — High intensity neutrino beam facility in Japan
Jefferson Lab (JLab) — The Thomas Jefferson National Accelerator Facility in the USA
PET — Positron Emission Tomography
PMT — Photo Multiplier
SiPM — Silicon Photo Multiplier
T2K — Tokaido to Kamioka neutrino experiment

[1] Barbara Frisken, Physics in Canada, Vo. 71, No. 3 (2015)

2. Staffing and Resources

2.1. Staffing - faculty, instructors, lab instructors, technicians, and support staff

Name	Position and Rank	Notes
Barbi, Mauricio	Associate Professor	Graduate Coordinator
Beech, Martin	Professor, Campion College	Associate Member of Department
Huber, Garth	Professor	Liaison to Faculty of Engineering
Kolev, Nikolay	Lecturer	Co-op Coordinator
Lolos, George	Professor	
Mobed, Nader	Professor	Department Head
Ouimet, Pierre	Lecturer	
Papandreou, Zisis	Professor	Undergraduate Coordinator
Szymanski, Shaun	Laboratory Instructor	
Teymurazyan, Aram	Assistant Professor	Fedoruk Chair in Nuclear Imaging
Tokaruk, Wayne	Laboratory Instructor	Term Appointment
Risling, Cheryl	Administrative Assistant	Shared position with Dean's Office

Name	Position and Rank	Notes
Semenov, Andrei	UofR Research Scientist	Adjunct Member
Tacik, Roman	TRIUMF Research Scientist	Adjunct Member

Note: Our Adjunct Members contribute by offering the occasional senior class, but mostly by co-supervising graduate students and providing day-to-day guidance on their work.

2.2. Resources

2.2.1. Teaching Space

Room	Capacity	Function
LB 125	24 (Equipped lab space)	Laboratory for Physics 111/112
LB 126	24 (Equipped lab space)	Laboratory for Physics 109
LB 129	12 (Equipped lab space)	Laboratory for Physics 372/471
LB 131	6 (Equipped computer lab)	Undergraduate Study Lounge
LB 132	24 (Equipped lab space)	Laboratory for Physics 119/201
LB 136	24 (Equipped lab space)	Laboratory for Physics 261/242/292
LB 228	6 (Audio-visual equipment)	Distance Education
CL 508/510	24 (Equipped lab space)	Laboratory for Astronomy 101/201/202

2.2.2. Research Space

Room	Function	Principal Investigators	Funding agency
LB 114	Graduate Student Office	Huber/Papandreou	Department
LB 116	Nuclear Imaging	Teymurazyan/Papandreou	Fedoruk/NSERC
LB 116.1	Graduate Student Office	Teymurazyan/Papandreou	Department
LB 117	T2K	Barbi/Mathie	NSERC/TRIUMF/UofR
LB 119	Hall C/JLab	Huber	NSERC
LB 123	Graduate Student Office	Barbi	Department
LB 127	Hall D/JLab	Papandreou/Lolos	NSERC/DOE/UofR/Fedoruk
LY 002	Cosmics, fiber testing	Papandreou/Lolos	UofR
AH 108	Computer/storage servers	Barbi/Papandreou	JLab-DOE/CFI

2.2.3.Specialized teaching equipment and instrumentation

Equipment/Instrumentation	Location	Notes
Senior Lab Courses	LB 129	DAQ, Compton, Cavendish, Speed of Light, advanced labs
Computer Lab	LB 131	For undergraduate students
Telescopes	CL 508	Two 10” domes, several 8” telescopes, and related
2nd Year Laboratories	LB 136	Hot-Air Engine, Wind Tunnel, Specialized Camera
Demonstrations	LB 134	Pulse Jet Bicycle, Kelvin's Thunderstorm, Ruben's Flame Tube, Scuba Tank Skateboard

2.2.4.Research equipment and instrumentation

Equipment/Instrumentation	Location	Funding agency	Notes
Measurement Instrumentation	LB 118 LB 127	NSERC/TRIUMF JLab/DOE/Fedoruk	Picoammeters, UV Laser, oscilloscopes
Data Acquisition Electronics	LB 118 LB 127	NSERC/TRIUMF JLab/DOE	NIM and CAMAC electronics
PCs and laptops for Data acquisition (DAQ)	LB 118 LB 127	NSERC/TRIUMF JLab/DOE	PCs running MIDAS software, laptop running SensL software
Individual SiPMs, PMTs	LB 118 LB 127		1x1mm^2, 3x3mm^2, PMTs and bases
Large Area and Matrix SiPMs	LB 127	JLab/Fedoruk	Arrays (1.3cm^2) and super-arrays (5x5cm^2) with electronics/software
Plastic Scintillators/Fibers	LB 118 LB 127	TRIUMF/NSERC	Various types & thicknesses, plus light guides
Exotic Scintillators	LB 116	Fedoruk	Light media for nuclear imaging
Mechanical	LB 118 LB 127	NSERC/TRIUMF	Several dark boxes, X-Y computerized stage, toolbox, electronics supplies
Electrical	LB 118 LB 127	NSERC/TRIUMF	Low and high voltage supplies, isolation transformer, cables, connectors
Optical bench	LY 002	UofR/NSERC	2x2m^2 vibration-proof table
Am-Be Neutron Generator	LB 130	UofR	

2.2.5.Research institutes, clusters, or specialized labs

The Prairie Particle Physics Institute (P3I)

P3I was created in 2005 by the President's Office (Director: Lolos), in recognition of the Department's work and reputation in the field of Subatomic Physics in Canada and internationally.

Initially P3I was allocated a budget of $35,000 per annum that supported (in part) a research scientist, travel and seminar speakers to the UofR. In 2006, a great opportunity arose for P3I to combine with the corresponding institutes at the Universities of Alberta (UofA) and Manitoba (UofM) to form a Prairie Regional Particle Physics Institute for the three western provinces that would have also been eligible for NSERC funding. Initial discussions in 2006 among the Vice Presidents (Research) of the three universities were very encouraging. However, sudden changes at the senior levels at both the UofR and UofA resulted in loss of time and momentum, which was followed later by a shift in priorities at the UofR and no desire by the administration to pursue this opportunity.

P3I continued to function for a few years in its original capacity, with a reduced budget, and several noteworthy speakers were invited to present seminars and public presentations that were sponsored or co-sponsored by P3I. At present, P3I is in a "stand by" mode, however, the recent creation of the Fedoruk Chair in Nuclear Imaging Technologies and the hire of Teymurazyan, as well as new, strong partnerships with the University of Saskatchewan can provide a new direction for P3I and a reactivation of its local and possibly regional role.

Specialized Labs

LB 127 — Detector Development Laboratory (GlueX/Nuclear Imaging): The GlueX group (Lolos, Papandreou) assumed the responsibility of the design, R&D and construction of the GlueX BCAL. This included all aspects, from the lead-fibre matrix design itself to the choice of scintillating fibers (SciFi's) and the all-critical read out sensors. LB 127 became a dedicated and custom-designed lab, where completed prototype modules, SciFi's and a new type of silicon-based photo-sensor (SiPM/MPPC) were extensively tested to the final completion of the project.

LB 127 is fully equipped to study SiPM/MPPC of several sizes and assemblies. Methods were developed to test these under various possible operating conditions and to optimize performance of integrated units coupled with several types of scintillating material, organic as well as inorganic. Rack-mounted electronics allow for the manipulation of signals from the SiPM/MPPCs, as well as the application of thresholds, signal logic and digitization. Additionally, the lab is equipped with two turnkey SensL-produced Matrix SM9 super-arrays, complete with electronics and software, for nuclear imaging studies of plants, based on Positron Emission Tomography (PET). It is expected that the lab will continue to play a role in the upgrades of the BCAL - and other GlueX detectors – as well as for nuclear imaging, as the sensor technology advances.

LB 116 — Nuclear Imaging Lab: This lab will soon be equipped with Canada's first plant PET imager (PhytoPET), consisting of position sensitive PMT heads coupled to LYSO crystals. The PhytoPET comes with its customizable mechanical supports, digitization electronics and full image reconstruction software. Commissioning, validation and calibration of the imager will take place in Regina before the PhytoPET moves permanently to Saskatoon for research in collaboration with the Sylvia Fedoruk

Canadian Centre for Nuclear Innovation and the Global Institute for Food Security in the areas of plant science and digital agriculture.

Note: LB 116 currently contains stowed equipment from the BCAL construction, that include the lead plastic deformation swager, one electro-pneumatic press table, and over $100,000 worth of 4-m long, 1-mm diameter, blue-green scintillating fibers. This equipment could be resurrected to construct small calorimeters for nuclear physics or nuclear imaging projects, as the need arises.

LB 119 — SHMS HGC: The Regina group (Huber) within the Hall C Collaboration at Jefferson Lab assumed the design, R&D and construction of the Heavy Gas Cherenkov detector. The work was carried out in the 2011-2013 period to a successful completion. LB 119 is a small lab with office space, used for optical component testing for the HGC. It is expected that this space will be utilized again for the SoLID Heavy Gas Cherenkov detector project, should the recently submitted grant application be funded by CFI.

LB 118 — T2K Laboratory: This large space consists of a main area and number of satellite rooms that house the electronics and other hardware in support of the T2K project in Japan (Barbi, Mathie, Tacik). The group was responsible for the R&D and construction of critical components of the FGD, as well as for the ongoing good performance of the wave-shifting fibers used in the FGD. Future use of this space is centred on the development of a novel optical system to instrument the next generation of neutrino oscillation experiments, including the upgrade of the Super Kamiokande detector to a megaton water detector, the Hyper-K. The group will be responsible for the light coupling of the PMT's in this system. An NSERC SAP RTI grant was submitted this fall.

Note: LB113 this is a large space that in the past was used for T2K, GlueX and HGC construction. Currently it houses the Faculty's machine shop. Its close proximity to all Physics research labs and its experienced machinist are certainly very useful for future physics hardware projects.

3. Scholarly Output

3.3.1.Summary

In this section, we present the research areas identified by the respective laboratories or activities with which the research is associated.

Jefferson Lab (JLab)

Jefferson Lab is considered the "premier" nuclear research facility in the world. The lab's primary mission is to conduct basic research of the atom's nucleus using the lab's unique particle accelerator, known as the Continuous Electron Beam Accelerator Facility (CEBAF). Huber, Lolos, and Papandreou were involved since the early physics definition studies in the late 80s, well before construction of the facility had begun. At that time this team assumed the design and construction of several critical detectors that are still in use to this day in one of the experimental halls (Hall A). The UofR was the first Canadian university – and only one for a number of years – involved at CEBAF. This, and the successful delivery of detectors proved critical in terms of the reputation and trust that the lab's management and the United States Department of Energy (DOE) – that funds lab operations – placed on the UofR group.

However, our most intense and impactful activity at Jefferson Lab has taken place in the time period covered in this report. Since the early 2000s the team assumed leading roles in two research thrusts: GlueX (Lolos and Papandreou) and Fπ (Huber), discovery and flagship experiments for the 12 GeV Jefferson Lab upgrade in experimental Halls D and C, respectively.

The primary goal of the Gluonic Excitations Experiment (GlueX) is to search for and ultimately study the pattern of gluonic excitations (normal and exotic matter) in the meson spectrum produced in photon-proton collisions. This promises to elucidate our understanding of quark confinement and to provide strict, quantitative tests of the current state-of-the-art theoretical models, which predict the properties of the exotic states. The experiment had received high priority by successive international review committees over the years, resulting in an $80 million investment towards the construction of Hall D and the GlueX detector. The BCAL, one of most critical GlueX detectors, is a "spaghetti calorimeter", consisting of 3,000 km of scintillating fibers sandwiched between thin sheets of rolled lead. The total detector cost was US$12 million, funded jointly between the US DOE and Jefferson Lab. This 28-ton detector was designed and constructed at the UofR, employing an army of Co-Op students from Physics and Engineering during the 2.5 year construction process. Numerous technical reports resulted from the R&D, construction and commissioning phases of this work as well as four instrumentation publications. The GlueX data taking commences in spring 2016 and will run continuously for at least five years.

Fπ (the pion form factor experiment in Hall C) has been formulated to probe the critical – and largely unexplored – transition region where meson exchange theories begin to fail to account for experimental results and the onset of QCD begins to manifest itself. The pion, due to its simpler structure and the availability of definitive predictions for its form factors at the asymptotic QCD limit, is an ideal tool to use as a probe. Fπ is not just one experiment but rather it's a program because it requires increasing beam energy to create a series of data that will span as wide a momentum transfer to the target as the accelerator beam energy will allow. With the successful conclusion of the first series of Fπ experiments, the recent energy upgrade of Jefferson Lab provides an excellent platform to launch the next program on Fπ. The Fπ program has significant UofR leadership. In addition to the SHMS HGC constructed at the

UofR, much of the data analysis of the experiment has been performed by Regina members, leading to several high-profile papers with UofR first authorship.

Both GlueX and Fπ will continue to occupy the time, effort and resources of the team for at least the time period 2016-2025. Both projects are fertile grounds for the education of graduate students and are expected to yield a large number of highly cited peer-reviewed publications.

The Tri-University Meson Factory (TRIUMF)

The Department has been associated with TRIUMF research since 1983, when Lolos was hired as an NSERC University Research Fellow at the UofR with the task of building up an intermediate energy group. Mathie was hired as in 1984, and research programs were undertaken in both the meson and proton halls. This relationship was expanded considerably in 1989, when the UofR became the first university in Canada to become an Associate Member of TRIUMF. As part of this agreement, Tacik was hired as a TRIUMF Research Scientist stationed permanently at the UofR and Huber was hired, initially, as a UofR Research Scientist.

During the next 15 years, a series of π-absorption (Lolos, Papandreou), π-production experiments (Lolos, Huber) and the π-scattering experiments with the CHAOS pion spectrometer (Mathie, Tacik) were carried out. Another significant UofR contribution was with the frozen-spin polarized target R&D and construction for the TWIST experiment. Mathie and Tacik were founding members of TWIST, a precision μ-decay experiment, which ran continuously until 2007. π/μ/e+ beams were also used for the testing and calibration of various detector components for Jefferson Lab (Lolos, Huber, Papandreou) including the Hall A aerogel Cherenkov and the GlueX BCAL. The TRIUMF detector shop also helped construct the focal plane hodoscopes for Jefferson Lab Hall A and the prototype BCAL light-guides.

Barbi, Mathie and Tacik are now members of the T2K Collaboration. Tokai to Kamioka (T2K) is a Japanese-led multinational physics experiment designed to unveil mysteries of the elusive particle, neutrino. High-intensity neutrino beams are directed from the J-PARC neutrino facility at Tokai towards Super-Kamiokande underground neutrino detector, 295km away. The Canadian effort is led by TRIUMF/ UBC. A suite of near detectors (ND280) located 280 m downstream of the production target is used to characterize the components of the beam before they have had a chance to oscillate and to better understand various neutrino interactions on several nuclei. UofR physicists carried out the wavelength shifting (WLS) fiber work on the fine-grained detectors (FGD) that serve as active targets in the ND280 tracker, including the development of a test system for the 10,000 WLS needed, and the development of the FGD particle identification algorithm. The 2015 Breakthrough Prize in Fundamental Physics (US$3 million) was awarded to five experiments investigating neutrino oscillation including T2K. 1,370 physicists, including UofR faculty and grad students, will share the prize. Team leader (Koichiro Nishikawa of Japan) accepted on behalf of the T2K collaboration.

In November 2015, the UofR formally applied to become a full member of the TRIUMF Consortium. We hope this will lead to future opportunities, such as joint faculty positions with TRIUMF.

Other Research Areas

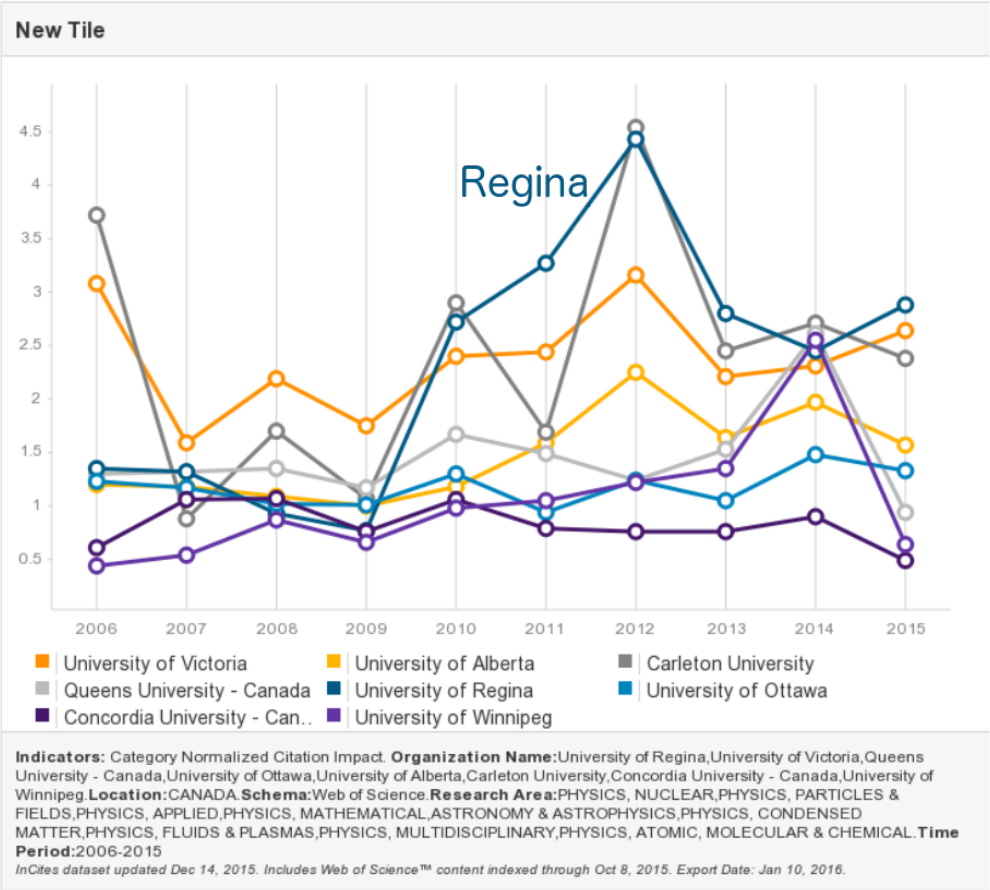
In addition to the critical-mass efforts listed above, there were contributions to the ATLAS program in terms of online analysis and simulations and theoretical efforts in the field of Lattice QCD. The two

faculty members leading those efforts have left our department and have not been replaced, nor has their NSERC funding and graduate students. Research efforts continue on LHC phenomenology, while new directions include paleontology and nuclear imaging. Specifically:

- After Dutta's departure from Regina to Texas A&M University, Kolev continued the collaboration with Dutta, his group and other Texas A&M researchers on LHC phenomenology with cosmological applications, such as dark matter. Kolev is an active participant in this effort since its inception and has contributed with ideas, computer simulations, data analyses, student interactions and presentation of the results, as well as in the publication of nine journal papers since 2006. This work is unfunded.
- The use of synchrotron radiation at the Canadian Light Source promises to address open questions in palaeontology, such as the preservation of soft tissues in fossils (Barbi). This effort, funded by the Faculty of Science, has led to several publications and much media attention (e.g. Discovery TV, Washington Post, phys.org, Globe & Mail). This effort is funded internally (UofR).
- The hardware expertise gained by the research exposure at TRIUMF and, particularly the multiyear R&D effort at Jefferson Lab with focus on sensor development for GlueX (Lolos and Papandreou), presented an opportunity to branch into the applied physics arena (nuclear imaging of plants and nuclear safety) based on nuclear physics techniques. This effort led to significant external funding from the Fedoruk Centre and NSERC Engage. In addition to its own scientific merit, such addition to the program has the potential to attract more undergraduate and graduate students. This new area is expounded upon under the opportunities in Section 7 (SWOT).

The department has had about 560 publications and 14,700 citations since 2006. The large jump in publications between 2011-2014 is due to the ATLAS Collaboration work, which ceased after Benslama's departure from the UofR. The citation record is more robust, as it includes not only the ATLAS Higgs boson papers, but also highly cited T2K papers on neutrino oscillations, and papers from the Jefferson Lab form factor program. Of the Department's 20 top cited papers between 2006-2015, 13 were from ATLAS (including those on the Higgs boson identification that led to the 2014 Nobel Prize), three were from T2K (leading to the 2015 Breakthrough Prize), two were from the Jefferson Lab pion form factor program, one was from the Jefferson Lab proton form factor program, and one was an astronomy paper by a lab instructor who is now retired (P. Bergbusch).

The 10 year Thomson Reuters Normalized Citation Index of the Department is summarized in the figure on the next page and compared to a selection of other Physics departments in Canada; it casts the Department in a favourable light.



3.3.2. Statistical summary of published and accepted scholarly work over the last ten years

Statistics from Thomson-Reuters "Web of Science" for the period 2006-2015

Scholarly Work	Number	Notes
Refereed journal articles	584	
Refereed conference proceedings	21	
Technical reports	69	
Refereed review articles	6	
Sum of citations for the 584 papers	14,809	
Number of citing articles	8,950	
Average citations per article	25.36	
Departmental h-index for 2006-15	49	

3.3.3.Grants and Contracts

Note that grants we are co-signatories on but where funds do not come to the UofR are not listed. The PI column in the table below encompasses cases where the Pi is the lead PI or Regina-based lead co-PI.

Principal Investigator (Co-Investigators not listed)	Funding Agency and Type	Total Amount (100% Assigned to Unit)	Dates
Huber, Garth	NSERC SAPIN (JLab)	$190,000	Apr 2006 - Mar 2010
Lolos, George	NSERC SAPPJ (GlueX)	$228,000	Apr 2006 – Mar 2008
Lewis, Randy	NSERC SAPIN (LQCD)	$315,000	Apr 2006 – Mar 2010
Mathie, Edward	NSERC SAPPJ (T2K)	$90,480	Apr 2006 – Mar 2007
Lolos, George	JLab BCAL contract	$130,042	Apr 2006
Barbi, Mauricio	NSERC SAPPJ (ILC)	$8,000	Apr 2006 – Mar 2007
Mathie, Edward	NSERC SAPPJ (TWIST)	$26,000	Apr 2006 – Mar 2007
Lolos, George	JLab BCAL contract	$20,293	Jun 2006
Barbi, Mauricio	NSERC SAPPJ (T2K)	$90,000	Apr 2007 – Mar 2008
Benslama, Kamal	NSERC SAPPJ (ATLAS)	$188,550	Apr 2007 – Mar 2008
Huber, Garth	JLab PDF contract	$52,000	Oct 2006 – Aug 2008
Lolos, George	JLab BCAL contract	$38,380	May 2007
Benslama, Kamal	NSERC SAPPJ (ATLAS)	$23,050	July 2007
Lolos, George	NSERC SAPPJ (GlueX)	$160,000	Apr 2008 – Mar 2009
Lolos, George	JLab PDF contract	$75,000	Apr 2008 – Apr 2009
Barbi, Mauricio	NSERC SAPPJ (ILC)	$3,500	Jun 2008 – Mar 2009
Huber, Garth	JLab PDF contract	$27,500	Aug 2008 – Aug 2009
Benslama, Kamal	CNRS exchange contract	$57,085	Sep 2008 – Aug 2009
Huber, Garth	NSERC SAPPJ (Mainz)	$13,000	Apr 2009 – Mar 2010
Lolos, George	NSERC SAPPJ (GlueX)	$620,000	Apr 2009 – Mar 2012
Mathie, Edward	NSERC SAPPJ (T2K)	$134,750	Apr 2009 – Mar 2010
Benslama, Kamal	NSERC SAPPJ (ATLAS)	$137,000	Apr 2009 – Mar 2010

Papandreou, Zisis	JLab BCAL contract	$52,480	May 2009
Papandreou, Zisis	JLab BCAL contract	$1,468,400	Sep 2009 – May 2012
Huber, Garth	NSERC SAP RTI-1 (JLab)	$125,000	Apr 2010 – Mar 2012
Huber, Garth	NSERC SAPPJ (Mainz)	$6,000	Apr 2010 – Mar 2011
Mathie, Edward	NSERC SAPPJ (T2K)	$168,292	Apr 2010 – Mar 2011
Benslama, Kamal	NSERC SAPPJ (ATLAS)	$139,000	Apr 2010 – Mar 2011
Huber, Garth	NSERC SAPIN (JLab)	$282,000	Apr 2011 – Mar 2016
Huber, Garth	NSERC SAPPJ (Mainz)	$30,000	Apr 2011 – Mar 2012
Lolos, George	NSERC SAPPJ (GlueX)	$437,000	Apr 2012 – Mar 2015
Huber, Garth	NSERC SAPPJ (Mainz)	$5,000	Apr 2012 – Mar 2013
Tacik, Roman	NSERC SAPPJ (T2K)	$177,915	Apr 2012 – Mar 2013
Papandreou, Zisis	Fedoruk (SiPM)	$118,430	Jan 2013 – Apr 2015
Tacik, Roman	NSERC SAPPJ (T2K)	$190,960	Apr 2013 – Mar 2014
Huber, Garth	NSERC SAPPJ (Mainz)	$30,000	Apr 2013 – Mar 2014
Papandreou, Zisis	NSERC Engage (Rad Mon)	$25,000	Nov 2013 – Aug 2014
Tacik, Roman	NSERC SAPPJ (T2K)	$66,186	Apr 2014 – Mar 2015
Huber, Garth	NSERC SAPPJ (Mainz)	$40,000	Apr 2015 – Mar 2016
Tacik, Roman	NSERC SAPPJ (T2K)	$138,095	Apr 2015 – Mar 2016
Papandreou, Zisis	NSERC SAPPJ (GlueX)	$405,000	Apr 2015 – Mar 2018
Papandreou, Zisis	Fedoruk Endowed Chair	$1,410,560	May 2015 – Jun 2020
Huber, Garth	CFI JELF (JLab)	$99,960	Mar 2016 (under review)
Teymurazyan, Aram	NSERC RTI (PET imaging)	$98,445	Apr 2016 (under review)
Teymurazyan, Aram	NSERC DG (imaging)	$380,128	Apr 2016 – Mar 2021 (under review)
Huber, Garth	NSERC SAPIN (JLab)	$846,149	Apr 2016 – Mar 2021 (under review)
Total (awarded)		**$7,942,948**	**2006 – 2015**

4. Community Service Initiatives

Southeastern Universities Research Association (SURA)

SURA is a consortium of 60 universities based out of Washington, DC, and operates the Jefferson Lab for the U.S. Department of Energy through Jefferson Science Associates. Based on the excellent record established by the UofR team at Jefferson Lab and, specifically our leading role in the GlueX program, SURA invited the UofR to be the first international full member of SURA and this was officially accomplished in 2010. Lolos and Papandreou have played active roles in the SURA governance since, participating or chairing key committees (Programs Steering Committee, Initiative Funds Committee, Fellowship Committee) and Papandreou is the appointed Trustee for the UofR.

Canadian Institute for Nuclear Physics

The UofR is one of the founding institutional members of the CINP, and we helped write its bylaws and helped pay for the incorporation legal expenses. The UofR administration was very supportive; it recognized this as an important opportunity to take a leading role in a national organization. Huber was the founding president, served on the CINP Board, and is now its Executive Director. Papandreou and Lewis had also served terms on the CINP Board. Papandreou is its webmaster.

Web sites and Social Media

We founded, installed and maintain the Division of Nuclear Physics and Canadian Institute of Nuclear Physics web sites. We operate a well-documented Departmental web site, Facebook and Twitter accounts as well as a Youtube channel.

Science Fair

For nearly twenty years the Physics Department has had a leadership role in organizing science fairs for the Regina region. Indeed this has been one of the key contributions made by the department to outreach efforts by the Faculty of Science as a whole. The Department's leadership in science fairs began in the late nineties when Mathie was one of the key players in organizing and hosting the 1997 Canada-Wide Science Fair (CWSF) in Regina. Following the CWSF 1997, Mathie became Chief Judge for the Regina Regional Science Fair (RRSF), one of 11 regional science fairs in Saskatchewan that feed into the CWSF. In 2009 Ouimet joined the RRSF organizing committee. Ouimet served as Assistant Chief Judge for RRSF 2010 and assumed the duties of Chief Judge for RRSF 2011. To help address a decline in participation in the RRSF, in 2012 Ouimet took a leadership role in moving the RRSF from local schools to the University of Regina, which has helped to reinvigorate the fair (up to 86 participants and 93 judges in 2015). Ouimet participated in the Regina Region's successful bid for the 2017 CWSF and will be serving as Local Chief Judge for CWSF 2017 with Mathie also lending his years of experience to the effort.

Science Rendez-vous

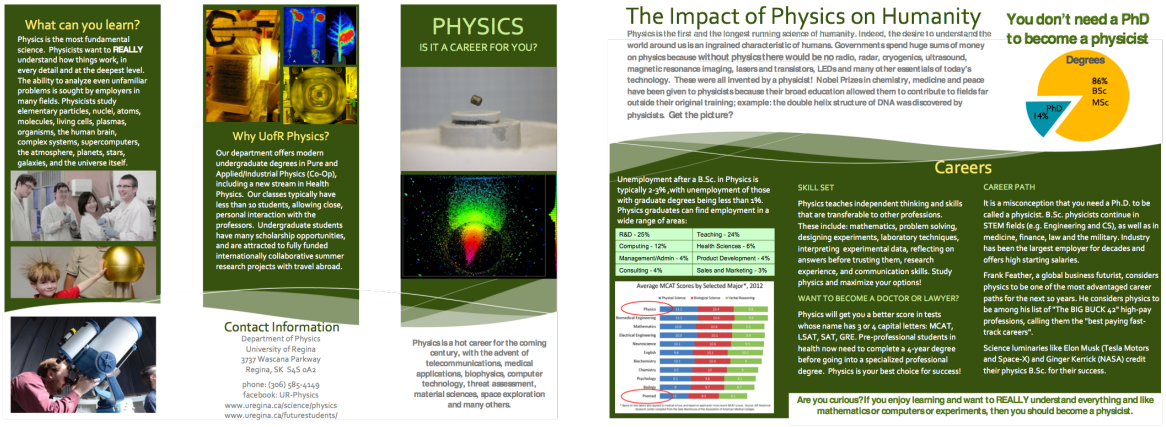
This is the Faculty of Science's Annual Open house, coordinated with and running on the same date each May as the national event. Physics plays a prominent role, with its jet bike and Rubens' tube of flames that dance to sound and form standing waves being two of the "hottest" attractions.

High School and Middle Years

The Department of Physics has participated in the Science and Kinesiology Summer camps offered at the University of Regina. Children, between the ages of six and twelve, participate in activities hosted by different science departments during the morning and then sports related activities in the afternoon. The physics department has organized many activities in the past including waves and optics demonstrations, electricity and magnetism demonstrations, paper airplane contests, rolling objects contests, tinfoil boat building contests and putt-putt boat building contests. Feedback from the children and camp counselors has been very positive and the physics activities are among their favorites. School groups are be given tours of our teaching and research facilities and shown the beauty of physics through exciting demonstrations, that include our scuba skateboard and jet bike, as well as demonstrations in waves and optics. Department members visit high schools during career days and by invitation to promote Science and Physics to grade 11 and 12 students. Recently, a member delivered a 75 min presentation to Grade 8 students in two schools, on the subject of "Constellations: Science and Greek Myths". We are planning hands-on research activities in our laboratories for interested Grade 12 students, and will continue tours for students and teachers, and other members of the public (e.g. girl & boy scout troops).

Recruitment

In the last year and half, our Outreach, Recruitment and Retention Committee has met with the Regina Public and Private School Division Liaison, high school councillors and science teachers, and UofR recruiters to explain our physics programs and career opportunities, thus establishing valued contacts in K-12 education. We have designed and distributed a new physics brochure (see screenshot below), which was received positively by UofR recruiters and teachers alike.



Public events

Department members have participated in the Science Pub series talks (at Bushwakker Pub) and offered evening public talks: Nuclear Science Week (2015) and Mysteries of the Universe Series (2008), while Jefferson Lab visitors have offered three evening events (2007, 2009, 2012), and we cosponsored (with CAP) the Year of Physics event in our Feynman Lecture (2005).

5. Programs Offered

5.1. Programs

The Department of Physics offers programs leading to B.Sc. and B.Sc. Honours in Physics as well as B.Sc. in Applied Physics. Co-operative Education programs with local industry play an important role in our undergraduate programs. Our graduate programs lead to M.Sc. and Ph.D. in Subatomic Physics.

Undergraduate Programs

All applicants admissible to Science may choose Physics as their major. The Department offers two streams of first year courses, a calculus-based and an algebra-based stream. Students have the option of entering the program through either of these two streams. The undergraduate degree in physics is a four-year program consisting of 120 credit hours. The contents and scope of the program are standard in that the emphasis is placed on understanding the core physics subjects in the following areas: Mechanics, Optics, Electricity and Magnetism, Fluid Mechanics, Thermal and Statistical Physics, and Quantum Mechanics. The program is enriched by a number of additional required and elective classes in Health Physics, Nuclear Physics, Particle Physics, Condensed Matter Physics, Mathematical Physics, and General Relativity. All of our undergraduate programs are designed to allow the option of obtaining a minor in other academic areas. The most popular minors for physics students are Mathematics and Computer Science. The Department also offers a minor for non-physics majors. While the option of registering in the Co-op exists for all of our programs, this is a degree requirement for the Applied Physics B.Sc. Program. The program templates and admission requirements can be found at:

- Admission requirements to Science
- Undergraduate programs in Physics
- Course Catalog (course description)

Co-op and Experiential Learning

Through the Co-op program, students have an opportunity to enhance their skills and to potentially identify a career path. Our programs are of five-year duration, including 8 semesters of study and 4-5 work terms. The students submit written Co-Op reports after each work term to our Co-Op Coordinator, who distributes the reports to faculty members for grading. The students also deliver a seminar to the Department in their final semester of study, which is also graded and feedback given to the students.

The Department has averaged about 4 students per semester enrolled in the Co-op program over the past 10 years. The main goal of this program is to offer students with the opportunity to dedicate a part of their undergraduate experience towards internship at different institutions from commercial to science-based, such as the Allan Blair Cancer Centre and AREVA Resources Canada. Additionally, our undergraduate students have the opportunity to work with faculty members on a variety of cutting-edge physics projects. Often the research requires travel to national and international locations to access world-class facilities. This experiential learning opportunity has served as a tool to recruit undergraduates for our graduate programs. Details:

- Co-Op Programs

Graduate Programs

The primary focus of research in the Department is Experimental Subatomic Physics.
The graduate course offerings thus include Quantum Mechanics, Electricity and Magnetism, Quantum Field Theory, Subatomic and Intermediate Energy Physics, and a host of special topic courses appropriate for specific research programs. In the recent past distance education methods have been utilized to

enrich the program and access some of the required courses. The student research is conducted at local, regional, national, and international facilities as detailed in the research section of this document. Additionally, members of the Physics Department are leading research programs in Nuclear Imaging and Paleo-Physics. Formal graduate programs for these areas of research are under development. The Nuclear Imaging project has created unique opportunities for interdisciplinary graduate and undergraduate programming with the Departments of Biology and Computer Science as well as the Faculty of Engineering and Applied Science. Details:

- M.Sc. and Ph.D. programs

5.2. Service teaching in support of other programs

The Department of Physics teaches service classes for programs in the Faculty of Science and the Faculty of Engineering and Applied Science. The B.Sc. programs in Biology, Chemistry, Biochemistry, and Geology each require six credit hours of first year physics. In addition, a number of pre-professional programs housed in Science including pre-medicine, pre-dentistry, pre-veterinary, and pre-optometry, require three to six credit hours of first year physics. All the B.A.Sc. programs in the Faculty of Engineering require six credit hours of first-year physics. Electronic System Engineering Program requires an additional second year physics course in Electricity and Magnetism. All the aforementioned courses have a laboratory component. The Secondary B.Ed. program in Physics includes six physics courses. Other programs in Science, Arts, Fine Arts, Education, Kinesiology & Health Studies, and Business Administration list physics as an option for their lab-based Science electives. The number of students in the service courses taught by the Department are shown in the table below, grouped by area and level.

Service to Faculties	Physics		Astronomy	
	100 Level	Higher Levels	100 Level	Higher Levels
Engineering	699	25	36	2
Science	362	6	76	3
Arts	60	6	81	-
All others	49		38	
Total	**1170**	**37**	**231**	**5**

We have been in communication with the Faculty of Engineering and Applied Science in connection to switching their first year students from Physics 109 (algebra based, half labs) to Physics 111 (calculus based, full labs). Should this change take place, this will present a significant resource issue to our department, particularly in connection to laboratory scheduling and delivery.

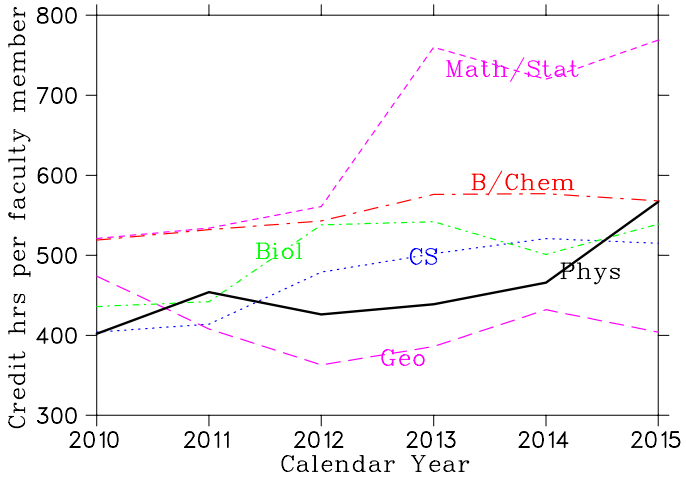
5.3. Enrollment trends

Service Enrollments

The total enrollment in first year physics courses has increased from 895 to 1202 students between the years 2006 - 2015. A significant part of this 25% increase has occurred in the past three years where the

enrollments rose from 1010 (in 2013) to 1202 (in 2015). The sharp rise in enrollments between 2013 and 2015 is the result of a dramatic increase in Engineering enrollments followed by an overall increase in the campus-wide enrollments.

Our enrolment trends and a comparison to sister departments in the Faculty of Science are captured graphically below.



Physics majors

The total number of undergraduate students majoring in Physics is 43. The number has been steady subject to small fluctuations resulting in a 10-year average of 25 students in undergraduate physics programs. The average number of physics graduands per year is 4. New programming initiatives in Applied Physics are underway. In addition, the Department is heavily engaged in student recruitment and retention activities. The goal is to double the number of physics graduands in a four year period. The CAP 2014 Summary of Departments shows an average number of B.Sc. graduates per year being 0.85 and 0.97 per faculty member and per research-focused faculty member, respectively. Our numbers are 0.50 and 0.80, respectively. Doubling the graduands will bring our numbers closer to the national averages.

Graduate enrollments

The Department of Physics currently has 11 graduate students. The number is expected to increase as the Nuclear Imaging research program gets established in the Department. In the past 10 years the number of physics graduate student has varied between 6 and 10 resulting in a 10-year average of 8 graduate students enrolled per year. In the calendar years 2006 - 2015, 3 Ph.D. and 12 M.Sc. candidates have convocated. The CAP 2014 Summary of Departments shows an average number of M.Sc. and Ph.D. graduates per year being 0.65 per research-focused faculty member. Our number is 1.5, which is more than double the national average.

5.4. Successes

Physics teaches independent thinking and skills that are transferable to other professions. These include: mathematics, problem solving, designing experiments, laboratory techniques, interpreting experimental data, reflecting on answers before trusting them, research experience, and communication skills. Our undergraduate curriculum, particularly when coupled to summer or Co-Op research projects, affords skills to our students that allow them to successfully compete in local or national awards. A significant number of our students have received NSERC Undergraduate Summer Research Awards, whereas two of our best students have received the President's Gold Medal and Governor General's Gold medal. Furthermore, one of our Ph.D. graduates received a prestigious Istituto Nazionale di Fisica Nucleare (INFN) two-year fellowship.

Our successes are measured also from the current occupations of our former students.

Occupations of former students

Photon Science Staff at Brookhaven National Lab, Science Associate at the Canadian Light Source, Instructor at Saskatchewan Polytechnic, Teachers in K-12, Instructor at EYES Camp (UofR), Grid Computer Specialist at UofT, Postdoctoral Fellow at University of Heidelberg on LHCb, Implementation Engineer at OPower Information Technology Services, Software Developer at iQMetrix, Radiation Safety Officer at the Cross Cancer Institute in Edmonton, Radiation Physicist at the Allan Blair Cancer Clinic, Medical Physicist at the Saskatchewan Cancer Agency, Medical Physicist at the Royal Victoria Hospital, Health Physicist at Cameco, Research Associate at Carleton University, among many others.

Testimonials from former students

"One of the best experiences I had during my education was helping construct the GlueX barrel calorimeter. It is a great feeling knowing that something you have helped to make will be used in future research for years to come and that you are a part of such a huge research project that can have a profound impact to science.'' - *Shaun Krueger, M.Sc. (2013), software developer at iQMetrix.*

"I'm a prairie boy," says Brent Giesbrecht. "I grew up in a small town. I had no idea what I was getting into when I decided to come to university. I am thankful I chose physics, because it led to this great opportunity to participate in international research." - *Brent Giesbrecht, B.Sc. Honours (2012), Health Physicist at Cameco.*

"On the farm, you cobble stuff together. If you need something, you make it yourself. Physics is a lot the same. Everything you make is a prototype." - *Blake Leverington, Ph.D. (2010), works on the LHCb project at CERN; he is a postdoctoral fellow at Heidelberg University in Germany.*

"I graduated from the UofR with an honours degree in Physics. I continued my post-graduate education at the University of Alberta where I obtained a Masters Degree in Medical Physics. The Physics Department is small but very strong, with excellent professors that provide incredibly good education and do their best to ensure their students are exposed to as much research and teaching experience as possible. In fact, many a times since I graduated and continued to pursue my career in Physics I felt grateful and proud for receiving an incredibly good Physics education at the UofR." *Sandra Vidakovic, B.Sc. Honours (2002) - currently Radiation Safety Officer at the Cross Cancer Institute in Edmonton.*

6. Unit Budget

The Physics Department budget is based on the yearly request submitted by the Department to the Faculty of Science. The Department budget for the fiscal years 2006-2007 through 2015-2016 is presented below.

FISCAL YEAR	TOTAL BUDGET
2006-2007	$85,215
2007-2008	$85,215
2008-2009	$85,215
2009-2010	$91,935
2010-2011	$91,935
2011-2012	$91,935
2012-2013	$97,386
2013-2014	$72,000
2014-2015	$76,919
2015-2016	$82,941

The lion share of the budget is used to support the program delivery while also providing financial support for physics graduate and undergraduate Teaching Assistants (TAs). The TA budget of the Department is further augmented by up to 3 Graduate Teaching Assistantships (GTAs) provided by the Faculty of Graduate Studies and Research. Over the years, special requests submitted by the Department to the Faculty of Science for major lab upgrades and equipment purchase have been favourably considered subject to the availability of funds. In sum, the Department is able to operate effectively within its budget allotment.

Percentage of Total Budget Allocated to Main Activities

Teaching Assistant Salaries	Non-Capital Expenditures	Capital Expenditures
80 %– 85% (Lab TAs and markers for large first year classes)	5% -10% (Departmental membership dues and office supplies)	5% - 10% (Maintenance, replacement, and purchase of new equipment for undergraduate labs)

The program delivery requires employing sessional lecturers, primarily to deliver the Physics 109 and 119 service classes. The budget for sessional stipends comes from two different sources: Faculty of Science, and Centre for Continuing Education (CCE). Classes scheduled at non-traditional times (evenings, weekends, Spring/Summer session) can be offered in partnership with CCE on a cost recovery basis. The number of physics classes taught by sessional lecturers is presented in the following table.

Academic Year	Number of courses taught by sessionals
2006-2007	2 (Science)
2007-2008	1 (Science)
2008-2009	1 (Science)
2009-2010	3 (CCE) + 2 (Science) = 5
2010-2011	2 (CCE) + 1 (Science) = 3
2011-2012	3 (CCE) + 2 (Science) = 5
2012-2013	4 (CCE) + 2 (Science) = 6
2013-2014	3 (CCE) + 2 (Science) = 5
2014-2015	4 (CCE) + 3 (Science) = 7
2015-2016	4 (CCE) + 2 (Science) = 6

The sustained increase in the number of sessional appointments starting in the academic year 2009-2010 can be attributed to reduction by 2 in the number of physics faculty members through attrition, scheduling additional introductory classes throughout the academic year in response to increase in enrollments, and the coverage of sabbatical leaves. A new faculty member (Teymurazyan) has joined the Department effective July 1, 2015. As Teymurazyan holds a Research Chair in Nuclear Imaging, the impact of his appointment on teaching loads will not be fully realized for the next three years.

7. SWOT Analysis (strengths, weaknesses, opportunities, threats)

7.1. Strengths

Research performance is undoubtedly the Department's main strength. The various sections in this Review document, coupled with the CV's of the faculty members, present a research activity and leadership that exceeds the norm for such a small Department. In addition, one should note that ours is the smallest Physics Department in the country that offers a full graduate degree program (M.Sc. and Ph.D.). All of the research focused faculty members are NSERC grant holders on an uninterrupted time line, and our external research grants and contracts per faculty member are among the highest at the UofR. Furthermore, all of our faculty have played major and/or leading roles in their respective experimental programs (GlueX, F_π, TWIST and T2K). The recognition of excellence is not limited to NSERC and other domestic sources of research funding but also to international agencies, with the more recent being the US DOE.

In order to develop this research excellence and impact in a small department, we have had to be very selective in the pursued research directions. A critical mass of graduate course offerings and research journal subscriptions can only be maintained if the Department's efforts are narrowly concentrated. Therefore, ours is addressing the needs of subatomic physics research, however, our graduate students receive all the basic graduate courses to build their knowledge background not only in Nuclear/Particle Physics but also on fundamentals such as electromagnetism and quantum scattering theory. The successes of our graduate students after graduation indicate the quality of our graduate program.

Just as important as the research projects our graduate students are involved in is their exposure to a highly competitive and scientifically advanced international arena at laboratories in Canada, Europe, the U.S. and Japan. The Department has also placed undergraduates on work terms at laboratories in the U.S. and Europe, and has had students from abroad do research projects on-campus with our faculty. In terms of internationalization, our Department ranks among the top at the UofR.

Our undergraduate program also has significant strengths. We serve two main groups, students in the Physics major stream and those in "service" classes for other degree programs, primarily in Science and Engineering. As discussed in this document, our service classes have seen a significant increase in enrollment, and the average number of credit hours taught per faculty member is now among the highest in the Faculty of Science. Our Physics major enrollment is stable, and the quality of instruction is very high, as evidenced by student testimonials and the teaching evaluations by the students in every level from the 100-series to 400-series courses they have taken. In national rankings, the UofR ranks high in the student to instructor ratios and the Physics Department offers this advantage to students in our program.

In an effort to attract additional students to the Physics major program, over the last 15 years we have undertaken some major undergraduate program initiatives. Our Physics Co-op programs are based on the Physics major programs with some additional requirements (e.g. employer work terms and in addition the Applied Physics B.Sc. majors can select from an enhanced list of Engineering and C.S. electives). They have been successful in demonstrating to students the practical usefulness of the Physics degree and helped our student retention. We have restructured the Physics Minor to make it more appealing to other majors in Science and Engineering and our enhanced recruitment efforts have met some initial success.

7.2. Weaknesses

The Department's main weaknesses are imposed by external factors, and, as such, we have limited means to mitigate their effects.

One weakness is the low Physics major enrollment compared to other Science programs. Physics, as an area of study, is well known as being challenging and students in local high schools are generally not exposed to such challenging topics, at least not correctly. This limits the number of local students who choose Physics as their major. In fact, a significant portion of declared Physics Majors (upon their initial entry into the UofR) is based on the fact that they found physics as one of the easiest topics in high school due to simple "substitute the number into the formula" learning used in many local schools. This, of course, does not reflect the reality of any university-level physics course. Unfortunately, our attempts to nurture these students have met with limited success, and the majority of such students change field of study very early in their studies and are lost to the physics stream. Those who remain, however, enjoy and benefit greatly from their Physics studies, and enjoy much success.

Another weakness, which greatly restricts the potential enrollment in our Applied Physics B.Sc. program, is that it is not P.Eng. accredited. Our Applied Physics B.Sc. curriculum is as close to an Engineering Physics curriculum as we can manage without P.Eng. accreditation, and we received the co-operation of the Faculty of Engineering when we set it up. But our attempts to create an Engineering Physics program at the UofR have met much political resistance, due to the provincial government's perceived overlap this would create with the successful program at the University of Saskatchewan.

As mentioned above, the Department has lost a number of research-focused faculty positions in the last 10 years. Despite our research successes, these positions were not replaced as research-focused ones, with the main reason given as the low physics majors enrollments, although low student enrollments in Physics Departments all over North America are a common phenomenon. These low enrollments, coupled with the UofR's stated thematic priorities for future program development, had placed Physics on low priority for support by the administration. Two positions were replaced at the lecturer level to meet the teaching mandate of the Department, with the associated loss in research capacity. While the Department has taken some actions to address the low enrollment situation many of the variables are beyond the Department's control. At its peak in 1996-8, the Department had 11-12 faculty members with a similar undergraduate population within the Physics stream. The recent appointment of the Fedoruk Chair is the first step towards redressing this issue.

7.3. Opportunities

In research, the Department is in an excellent position to capitalize on its record and take advantage of present and future research projects. GlueX is just starting its data-taking runs and the nature of the Collaboration and the detector capabilities will produce a wealth of data that will push the knowledge envelope in the QCD-confinement region. Furthermore, upgrades on the detectors are almost a given and opportunities for major involvement by faculty and students will be there. The F_π program within the Hall C Collaboration will enjoy years of data taking with equally impressive opportunities for faculty and students. Detector upgrades are in fact already in the planning stages and, just like in GlueX, our past contributions have been recognized and participation in the future upgrades will provide major

opportunities. In a similar fashion, T2K will move to upgrades coupled with the construction of new neutrino facilities in the complex enterprise of accelerator and detector systems in Japan. The only limits to what the Physics Department can contribute to the above areas of research are due to external research funding by Canadian and foreign sources and, of course, the number of faculty members that are available. The latter will also define the number of graduate students that the Department can support and supervise.

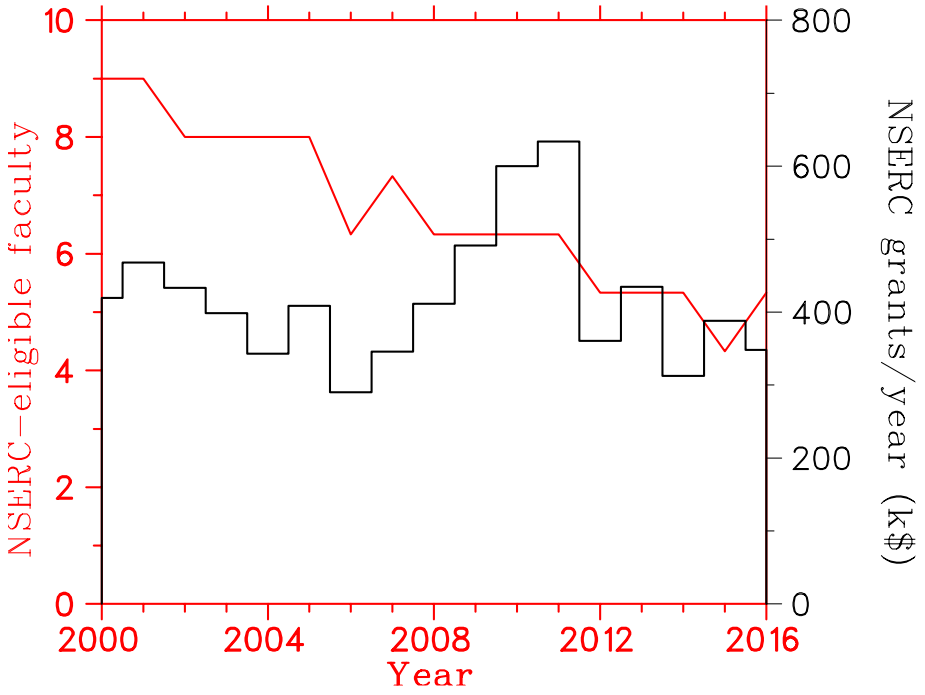
The recent partnership with the Fedoruk Centre is another large opportunity before the Department. The mandate of this provincially funded institute is to place Saskatchewan among the global leaders in nuclear research, development and training. Our Department's photo-sensor expertise is a natural fit into the *Nuclear Imaging Technologies* and the *Nuclear Safety Applications* of the institute's mandate. Our group was awarded one of the first five Fedoruk project grants. This led to a successful NSERC Engage grant, and finally to a successful joint program application with the University of Saskatchewan for $5.2million, to create three five-year, bridge-funded faculty positions, with one awarded to our department: the Fedoruk Chair for Nuclear Imaging Technologies. This Chair was filled in mid-2015 (Teymurazyan).

Our intention is to use this strategic investment towards the creation of the Saskatchewan Program in Nuclear Imaging to establish a curriculum in Health Physics 319 in cooperation with local partners, such as Saskatchewan Polytechnic. Our existing Health Physics class is currently broadcast to students at the University of Saskatchewan, and we hope the curriculum enhancements will lead to further increases in our enrollment and help draw new students to the Physics major programs. We are well positioned to take advantage of the Fedoruk-funded 24 MeV cyclotron and associated nuclear sciences laboratory facility at the Saskatchewan Centre for Cyclotron Sciences (SCCS) in Saskatoon. Additionally, the Global Institute for Food Security (GIFS) at the University of Saskatchewan has recently received a $37.2 million CFREF award to harness the power of genomics by linking phenotypes (breeding traits) to genotypes (DNA sequences). We have already built and joined a multidisciplinary collaboration of researchers from various fields (Agriculture, Plant Sciences, Biology, Physics, CS) from the universities of Regina, Saskatchewan and Lethbridge. Moreover, our work in Nuclear Safety is in partnership with industry. The NSERC Engage grant funded a proof-of-principle project to develop and advance low cost, rugged, small, unobtrusive, easy to use radiation detectors for first responders and general consumers, based on silicon photomultipliers (completed) and a new target is the development of radiation detection robotic systems for deployment in uranium mines.

Finally, the UofR has recently applied to become a full member of the TRIUMF consortium, on the basis of our Department's research excellence in subatomic physics and our historic contributions to the TRIUMF on-site program, such as TWIST. In the longer term, we hope this will lead to a bridge faculty opportunity with TRIUMF for our Department.

7.4 Threats

Given the continuous reduction of research-active faculty positions shown in the figure below, the state of our M.Sc. and Ph.D. programs is precarious. The further erosion of these programs would not only have substantive impact upon our research productivity and external funding, but it will also have substantial impact upon our ability to offer service classes to the Faculties of Science and Engineering.



Particularly with the loss of research-active theorists, we are experiencing a difficulty offering graduate classes in subatomic physics when required by our students. Very fortunately, we have been able to supplement our graduate offerings with broadcast classes from TRIUMF/UBC and the University of Saskatchewan, so the impact upon our current graduate students has been limited up to now. But if we suffer further losses of research faculty, our graduate programs will no longer be viable.

With the loss of the M.Sc. and Ph.D. programs, the Department would be unable to rely upon Graduate Teaching Assistants to teach the ~55 laboratory sections, the overwhelming majority of them for our service classes. To compensate, the UofR would have to hire three additional full-time lab instructors at significantly greater cost. The paradox is that given the substantial external research funding that our faculty bring in, it is ultimately cheaper for the UofR to restore lost academic positions than it is to not replace them and hire more full-time lab instructors instead.

We hope this Departmental Review will help make the case for the restoration of lost capacity. In light of the 2016 upcoming retirement (Lolos), an urgent replacement in the faculty ranks is absolutely necessary for the survival of our programs.

Appendix

Short Curricula Vitae of the Physics Department Academic Staff Members

Name	Position and Rank
Barbi, Mauricio	Associate Professor
Huber, Garth	Professor
Kolev, Nikolay	Lecturer
Lolos, George	Professor
Mobed, Nader	Professor
Ouimet, Pierre	Lecturer
Papandreou, Zisis	Professor
Szymanski, Shaun	Laboratory Instructor II
Teymurazyan, Aram	Assistant Professor
Tokaruk, Wayne	Laboratory Instructor I

Mauricio Barbi

Associate Professor

barbi@uregina.ca, (306) 585 4260,

Education and Professional Development

1998 - Ph.D., Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, RJ, Brazil, supervisor Prof. F. Marroquim (UFRJ).

1994 - M.Sc., Federal University of Santa Catarina, Florianopolis, SC, Brazil, supervisor Prof. F.F. Souza Cruz.

1991 - B.Sc., Federal University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil

Employment History

2004 - Tenure-track Assistant Professor

2008 – Promotion and Tenure

2008 to now - Associate Professor

Teaching History

Phys-109: General Physics I – 2009-2014.

Phys-242: Introduction to Modern Physics – since 2005

Phys-471: Honours Physics Laboratory – since 2005

Phys-411: Advanced Classical Mechanics – 2006-2007

Student Supervision

List undergraduate students, graduate students, post-doctoral fellows, and other relevant trainees carrying out research or other original scholarly activity under your direct supervision within the past ten years. Use the table below to list names, position, and dates of supervision. Additional comments can be made below the table.

Name	Position	Dates of supervision
Anezka Kolaceke	*PhD student*	*2014/9 -*
Juan Velasquez	*MSc student*	*2014/9 -*
Spencer Giffin	*PhD student*	*2009/5 -*

Thomas Tolhurst	*MSc student*	*2011/9 - 2013/10*
Anezka Kolaceke	*MSc student*	*2011/9 – 2014/1*
Caio Licciardi	*PhD student*	*2007/9 – 2012/10*
Blair Jasper	*MSc student*	*2006/9 – 2011/3 (did not complete degree)*
Laura Teigrob	*Research assistant*	*2015/5-2015/9*
Jessica Cavalcante	*Research assistant*	*2014/5-2014/9*
Eduardo Quijano	*Research Assistant*	*2013/5 – 2013/9*
Brent Giesbrech	*Research Assistant*	*2011/4 – 2011/9*
Anezka Kolaceke	*Research Assistant*	*2011/1 – 2011/3*
Andrew Lim	*Research Assistant*	*2009/4 – 2009/9*
Thomas Tolhurst	*Research Assistant*	*2009/4 – 2009/9*
Andrew Urichuk	*Research Assistant*	*2008/4 – 2009/3*
Benjamin Harack	*Research Assistant*	*2008/4 – 2009/3*
Nathaneal Hogan	*Research Assistant*	*2008/4 – 2009/3*
San Schonhoffer	*Research Assistant*	*2008/4 – 2009/9*
Benjamin Freitag	*Research Assistant*	*2007/4 – 2008/9*
Carolyn Ingram	*Research Assistant*	*2007/4 – 2008/3*
Christine Carbno	*Research Assistant*	*2007/4 – 2008/3*
Greg Williams	*Post-doctoral fellow*	*2009/4 – 2010/1*
Nick Hastings	*Post-doctoral fellow*	*2010/5 -*
Chungcheng Xu	*Post-doctoral fellow*	*2005/1 – 2006/4*

University Service

1. *Member of the 3rd/4th year Lab Committee, Department of Physics, UofR.*
2. *Coordinator of the Physics Co-op Liaison Program, Department of Physics, UofR.*
3. *Member of the University of Regina Executive of Council Committee, UofR.*
4. *Member of the Student Appeals Committee, Faculty of Sciences, UofR.*
5. *Member of the Physics Honours Seminar Committee, Department of Physics, UofR.*
6. *Member of the NSERC/USRA Graduate Studies Committee, Graduate Studies, UofR.*
7. *Member of the NSERC PGS-CGS Competition Selection Committee, Graduate Studies, UofR.*
8. *Member of the Laboratory Instructor Review Committee, Faculty of Sciences, UofR.*
9. *Member of the Ph.D. comprehensive exam committee, Department of Physics, UofR.*
10. *Member of MSc thesis defense committees (Physics and other departments), UofR.*

11. *Member of PhD defense committees (Physics and other departments), UofR.*
12. *Member of the Search Committees for faculty positions, Department of Physics, UofR.*
13. *Member of the Council Committee on the Faculty of Graduate Studies and Research, UofR.*

Most Significant Research Contributions

1) The Tokay to Kamioka (T2K) project (July 2006 – present): I led the wavelength shifting (WLS) fiber work-package for the Fine Grained Detector (FGD) of the Near Detector (ND280) for the T2K neutrino oscillation experiment [21]. The aim of this experiment is to study the phenomena of neutrino oscillations. The importance resides in the fact that contrary to what was previously believed (until very recently), neutrinos do possess non-zero masses. The consequence is that a neutrino of one species can transform (oscillate) into a neutrino of a different species (there are three different species of neutrinos). This fact can be associated to an asymmetry between the generation of matter and anti-matter, and might help to explain why matter has dominated the universe after the Big-Bang. The main objectives of T2K experiment are to measure some of the neutrino oscillation parameters, and to identify a non-zero matter/anti-matter asymmetry, also know as CP violation, in the neutrino sector of the Standard Model of Particle Physics. My efforts in this project include the design and construction of a dedicated test system for the quality control and characterization of 10000 WLS fibers needed for the FGD. Also, with my graduate students, I developed the particle identification (PID) algorithm for the FGD, have been developing physics analyses using the accumulated T2K data to date, and am currently exploring the possibility of identifying neutrons from neutrino interactions in the FGD and improve the FGD track reconstruction with the aim of improving the systematic uncertainties in the T2K physics analyses.

2) I recently started to participate in the first stages of a project, along with other Canadian colleagues, to develop and test the optical system for the proposed upgrade of the T2K experiment, or more generally, for the next generation of neutrino oscillation experiments. This optical system will instrument the Hyper-Kamiokande (HK) detector, which is expected to replace the current T2K far detector, the Super-Kamiokande (SK). The system consists in spherical acrylic vessels containing a number of photomultiplier sensors. I am responsible for the light coupling between the photomultipliers and the acrylic vessels. One of the importance of such a system is that it will significantly enhance the total photocathode coverage of the detector, adding higher segmentation than that currently available in detectors such as the SK. This will result in better particle identification and higher statistics, two crucial points for neutrino oscillation experiments. Given that these photosensors will be immersed in huge volumes of water (the water serves as a Cherenkov detector), the proposed design and system specifications will offer protection against pressure. The configuration of the system and the installation of the sensors in the acrylic vessel will also remove the need for compensation of the Earth's magnetic field. Ultimately, the option of using significantly smaller photomultipliers than those currently used in existing detectors has the potential to reduce the overall cost for an equivalent photosensitive area.

3) Use of Physics Tools in Paleontology (July 2011 - present): I initiated a new project in 2011 that uses synchrotron radiation to address questions in paleonotology. I was the first one to use this method in Canada. My research has already led to an important observation related to the preservation of soft tissues in fossils, and has yielded two publications, one regarding the application of synchrotron radiation to studies in paleontology [1], and another concerning a method to extract element concentrations in fossil samples in measurements using polychromatic synchrotron radiation (photon) beams [2]. This project has also attracted significant media attention, with several interviews and material featuring in TV, radio, newspapers, magazines and blogs such as Discovery Channel TV (Daily Planet show), CTV, CBC TV, Leader Post, Globe and Mail, Washington Post, phys.org, DiscoveryNews.com (YouTube Channel), Smithsonian Online Magazine, to name a few. The following items cover some of the areas I have been working on: chemical speciation, mapping and imaging of vertebrate fossils from the late Cretaceous; search for organic traces in fossils; study of bone microstructures. My activities in Canada have inspired other Canadian scientists to use the same methods for studies in paleontology. It is also unique in its interdisciplinary character. I closely collaborate with paleontologists, biologists, geologists, and scientists from the CLS. Through this project, I have already graduated an MSc student (Thomas Tolhurst), and am currently supervising a PhD student (Anezka Kolaceke). I was also very fortunate to come across a very rare and well-preserved fossilized three-dimensional skin of a hadrosaur while helping in the excavation of this specimen. I have spent the last 2 and half years thoroughly studying the skin, and have recently made a very important discover related to the preservation of cellular structures in the epidermis of this specimen.

List of Recent Publications (Past 5 Years)

1. *Hyper-Kamiokande Working Group Collaboration (K. Abe et al.). (2015). A Long Baseline Neutrino Oscillation Experiment Using J-PARC Neutrino Beam and Hyper-Kamiokande. Physics HEP arXiv.org. arXiv:1412.4673*
2. *K. Abe et al. (T2K Collaboration). (2015). Measurement of the electron neutrino charged-current interaction rate on water with the T2K ND280 $π^0$ detector. Phys.Rev. D. 91(11)*
3. *T2K Collaboration (K. Abe et al.). (2015). Measurement of the ν_{μ} charged current quasi-elastic cross section on carbon with the T2K on-axis neutrino beam. Phys. Rev. D. 91(11)*
4. *Hyper-Kamiokande Proto- Collaboration (K. Abe et al.). (2015). Physics potential of a long-baseline neutrino oscillation experiment using a J-PARC neutrino beam and Hyper-KamiokandeBy Hyper-Kamiokande Proto- Collaboration. Prog. Theor. Exp. Phys.5(053C02)*
5. *K. Abe et al. (T2K Collaboration). (2015). Neutrino Oscillation Physics Potential of the T2K Experiment. Progress of Theoretical and Experimental Physics. 4(043C01)*
6. *T2K Collaboration (K. Abe et al.). (2015). Measurements of neutrino oscillation in appearance and disappearance channels by the T2K experiment with 6.6×10^{20} protons on target. Phys.Rev. D. 91(7)*

7. *K. Abe et al. (T2K Collaboration). (2015). Search for short baseline ve disappearance with the T2K near detector. Phys. Rev. D.91(5)*

8. *T. Tolhurst, M. Barbi (corresponding author), T. Tokaryk. (2015). Effective beam method for element concentrations. Journal of Synchrotron Radiation. 22(2): 393-399.*

9. *T2K Collaboration (K. Abe et al.). (2015). Upper bound on neutrino mass based on T2K neutrino timing measurements. Physics HEP arXiv.org. arXiv:1502.06605*

10. *K. Abe et al. (Hyper-Kamiokande Working Group). (2014). A Long Baseline Neutrino Oscillation Experiment Using J-PARC Neutrino Beam and Hyper-Kamiokande. arXiv. arXiv:1412.4673*

11. *M. Barbi, T. Tokaryk, T. Tolhurst. (2014). Synchrotron Radiationas as a Tool in Paleontology. Physics in Canada. 70(1)*

12. *K. Abe et al. (T2K Collaboration). (2014). Measurement of the νμ CCQE cross section on carbon with the ND280 detector at T2K. arXiv. arXiv:1411.6264*

13. *K. Abe et al. (T2K Collaboration). (2014). Measurement of the neutrino-oxygen neutral-current interaction cross section by observing nuclear de-excitation γ rays. Phys. Rev. D. 90(7): 072012.*

14. *K. Abe et al. (T2K Collaboration). (2014). Observation of Electron Neutrino Appearance in a Muon Neutrino Beam. Phys. Rev. Letter. 112: 061802.*

15. *K. Abe et al. (T2K Collaboration). (2014). Measurement of the inclusive νμ charged current cross section on iron and hydrocarbon in the T2K on-axis neutrino beam. Phys. Rev. D. 90(5): 052010.*

16. *K. Abe et al. (T2K Collaboration). (2014). Precise Measurement of the Neutrino Mixing Parameter theta_23 from Muon Neutrino Disappearance in an Off-Axis Beam. Phys. Rev. Letter. 112(18): 181801.*

17. *K. Abe et al. (T2K Collaboration). (2014). Measurement of the Inclusive Electron Neutrino Charged Current Cross Section on Carbon with the T2K Near Detector. Phys. Rev. Lett.113(24): 241803.*

18. *K. Abe et al. (T2K Collaboration). (2014). Recent Results from the T2K Experiment. Nucl. Phys. Proc. Suppl.246-247: 23-28.*

19. *K. Abe et al. (T2K Collaboration). (2014). Measurement of the intrinsic electron neutrino component in the T2K neutrino beam with the ND280 detector. Phys. Rev. D. 89(9): 092003.*

20. *E. Kearns et al. (Hyper-Kamiokande Working Group). (2013). Hyper-Kamiokande Physics Opportunities. arXiv High Energy Physics. arXiv:1309.0184v1*

21. *K. Abe et al. (T2K Collaboration). (2013). Measurement of Neutrino Oscillation Parameters from Muon Neutrino Disappearance with an Off-axis Beam. Phys. Rev. Letter. 111(21): 211803.*

22. *K. Abe et al (T2K Collaboration). (2013). Measurement of the Inclusive NuMu Charged Current Cross Section on Carbon in the Near Detector of the T2K Experiment. Physics Review D. 87(9): 092003.*

23. *K. Abe et al (T2K Collaboration). (2013). Evidence of Electron Neutrino Appearance in a Muon Neutrino Beam. Physics Review D. 88(3): 032002.*

24. *K. Abe et al (T2K Collaboration). (2013). The T2K Neutrino Flux Prediction. Phys. Rev.D. 87: 012001.*

25. *P.-A. Amaudruz et al. (2012). The T2K Fine Grained Detectors. Nucl. Instrum. Meth A. 696: 1-31.*

26. *K. Abe et al. [T2K Collaboration]. (2012). First Muon-Neutrino Disappearance Study with an Off-Axis Beam. Phys. Rev. D. 85(3): 031103.*

27. *K. Abe et al (T2K Collaboration). (2011). The T2K Experiment. Nucl. Instrum. Methods A. 659(1): 106-135.*

28. *K. Abe et al (T2K Collaboration). (2011). Measurements of the T2K neutrino beam properties using the INGRID on-axis near detector. Nucl. Instr. and Meth. A. 694: 211-223.*

29. *K. Abe et al. (T2K Collaboration). (2011). Indication of Electron Neutrino Appearance from an Accelerator-produced Off-axis Muon Neutrino Beam. Phys. Rev. Lett. 107(4): 041801.*

29. *CALICE Collaboration. (2011). CALICE Report to the DESY Physics Research Committee. physics.ins-det.*

30. *Toshinori Abe et al. (Linear Collider Collaboration). (2010). The International Large Detector: Letter of Intent. arXiv. arXiv:0712.2356*

31. *Adloff, C and Blaha, J and Blaising, J-J and Chefdeville, M and Drancourt, C and Espargliere, A and Gaglione, R and Geoffroy, N and Karyotakis, Y and Prast, J and others. (2010). CALICE Report to the DESY Physics Research Committee. Physics arxiv.org.*

External Research Funds

1. *2014/4-2017/3: $2,625,000 - Canadian participation in the T2K neutrino oscillation experiment, NSERC SAP project grant. Portion of Funding Received ($480,000). PI: Scott Oser + 18 others*
2. *2011/4-2014/3: $4,830,000 - Canadian participation in the T2K neutrino oscillation experiment, NSERC SAP project grant. Portion of Funding Received ($480,000). PI: Akira Konaka + 18 others*
3. *2010/4-2011/3: $27,000 - T2K Near Detector Completion, NSERC SAP RTI grant. Portion of Funding Received ($3,000). PI: Akira Konaka + 18 others*
4. *2009/4 – 2011/3: $3,500,000 - The T2K Long Baseline Neutrino Experiment, NSERC SAP project grant. Portion of Funding Received ($350,000). PI: Akira Konaka + 18 others*
5. *2009/4-2010/3: $240,000 - T2K Near Detector Integration, NSERC SAP RTI grant. Portion of Funding Received ($40,000). PI: Akira Konaka + 18 others*
6. *2008: $18,900 – NSERC SAP RTI Grant. This grant was transferred from TRIUMF for the development of the Wavelength Shifting Working Package at the University of Regina.*
7. *2008: $130,000 - T2K Common Fund Contribution, NSERC SAP RTI Grant, with A. Konaka (PI) and 18 others.*
8. *2008: $75,000 - ILC Detector Development, NSERC SAP Project Grant, with M. Dixit (PI) and 4 others.*

9. *2008: $18,700 – NSERC SAP Project Grant. This grant was transferred from TRIUMF for the development of the Wavelength Shifting Working Package at the University of Regina.*
10. *2008: $24,000 –NSERC SAP RTI Grant. This grant was transferred from TRIUMF for the development of the Wavelength Shifting Working Package at the University of Regina.*
11. *2007/4-2009/3: $90,000 - Neutrino Oscillation with the T2K Experiment, NSERC SAP Individual Discovery Grant, M. Barbi.*
12. *2007-2008: $130,000 - Electronics for the T2K Fine Grained Detector, NSERC SAP RTI Grant, with A. Konaka (PI) and 19 others.*
13. *2007: $130,000 - T2K Common Fund Contribution, NSERC SAP Project Grant, with A. Konaka and 17 others.*
14. *2006: $30,000 – NSERC SAP RTI Grant. This grant was transferred from TRIUMF for the development of the Wavelength Shifting Working Package at the University of Regina.*
15. *2006: $215,100 - Data and Computing Grid Laboratory, CFI New Opportunities plus matching funds, with T. Chan (PI) and P. Fong.*
16. *2006: $114,000 - GlueX- Canada: The Physics of Confinement Probed Through Gluonic Excitations, NSERC SAP Project Grant, with G. Lolos (PI) and 3 others. (I withdrew from this project in May 2006).*
17. *2006-2007: $47,500 - Linear Collider Detector, NSERC SAP Project Grant, with D. Karlen (PI) and 8 others.*
18. *2005: $30,000 - Search for Gluonic States in Exotic Hybrids and Glueballs, NSERC SAP Individual Discovery Grant, M. Barbi.*

Garth Huber

Professor of Physics
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Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Experimental Intermediate Energy Nuclear Physics	University of Regina	February, 1988
B.Sc.	Physics (High Honours, Co-Op)	University of Regina	May, 1984
B.Sc.	Mathematics (Great Distinction)	University of Regina	May, 1984

Employment History

Professor (Full)	University of Regina	July, 2003 - present
Executive Director	Canadian Institute of Nuclear Physics	May, 2013 – present
Visiting Faculty	University of Washington, Seattle	September, 2009
Sabbatical Researcher	Jefferson Lab, Newport News, VA	January-August, 2003

Teaching History (Last 10 Years)

Course	Title	Years Taught
PHYS 109	General Physics I	2006
PHYS 201	Electricity & Magnetism	2007, 08, 10, 11, 12, 13, 14, 15
PHYS 311	Electromagnetism I	2013
PHYS 322	Physical Optics and Electromagnetic Radiation	2005, 06, 07, 09, 11, 12,13
PHYS 342	Atomic Physics	2006, 07, 08, 09
PHYS 442	Introduction to Elementary Particle Physics	2005
PHYS 471	Modern Experimental Physics II	2012
PHYS 800	Classical Electrodynamics	2007, 10, 11, 16
PHYS 890AE	The Structure of the Proton	2014
PHYS 890AF	The Structure of the Proton II	2015

Student and Post-Doctoral Supervision (Last 10 Years)

Name	Position	Dates of Supervision	Current Employment
Postdoctoral & Relevant Trainees			
Martel, Philippe	Post-Doctoral R.A. (co-supervisor)	Sept, 2013 - present	
Ahmed, Zafar	Post-Doctoral Fellow	July, 2013 - present	
Middleton, Duncan	Post-Doctoral R.A. (co-supervisor)	Nov, 2009 - Apr, 2014	UK National Health System analyst
Butuceanu, Cornel	Post-Doctoral Fellow	Sept, 2006 - Aug, 2009	Ackerman Cancer Center, Jacksonville FL
Chuncheng, Xu	Post-Doctoral Fellow (co-supervisor)	Jan, 2003 - Apr, 2006	Consultant, Vancouver BC
Graduate Students			
Li, Wenliang	Ph.D. student	Jan, 2013 - present	
Paudyal, Dilli	Ph.D. student	Sept, 2012 - present	
Basnet, Samip	M.Sc. student	Sept, 2015 - present	
Li, Wenliang	M.Sc. student	Sept, 2010 - Dec, 2012	UofR grad student
Undergraduate Students			
Avila, Ethan	Undergraduate Researcher (co-supervisor)	May-Aug, 2015	
Davis-Purcell, Benjamin	Undergraduate Researcher (co-supervisor)	May-Aug, 2014	McMaster grad student
Fitz-Gerald, Thomas	Undergraduate Researcher	May-Aug, 2013	UofR math grad student
Fischer, Alex	Undergraduate Researcher	May-Aug, 2012	Quadrant Newmedia, Saskatoon SK
Croshaw, Jeremy	Undergraduate Researcher (co-supervisor)	May-Aug, 2011	U. Saskatchewan grad student
Urichuk, Andrew	Undergraduate Researcher (co-supervisor)	May-Aug, 2010	U. Lethbridge grad student
Sichello, Lee	Undergraduate Researcher	May, 2010 - Aug, 2011	iQmetrix, Raleigh NC
Selles, Paul	Undergraduate Researcher	May-Aug, 2009	iQmetrix, Regina SK
Sauder, Matthew	Applied Physics Project Advisor	Jan-April, 2013	
Sichello, Lee	Applied Physics Project Advisor	Sept-Dec, 2012	iQmetrix, Raleigh NC

University Service (Last 10 Years)

Department of Physics Service

Academic Review Steering Committee (2015), Curriculum Committee (2004-present), Physics Library Representative (2007-present), Lab Committee (2012-13), Graduate Coordinator (2005-2007), Co-Op Committee (1998-2008), Ph.D. committee member for Anezka Kolacke (2015-), Spencer Giffin (2011-14), Caio Licciardi (2010-12), Blake Leverington (2007-10)

Faculty of Science Service

Dean of Science Search Committee (2015), Faculty-Peer Review Committee (2012-2014, chair 2013-14), Microbiology Faculty Search Committee (2008), Science Representative to the Faculty of Engineering (2011-present), Lab Instructors Review Committee (2005-06), Student Appeals Committee (2004-06), Ph.D. commitee member for Nikhil Aravindakshan (Chemistry, 2015-)

Other UofR Service

University Council Committee on Academic Mission (2015-17), Faculty of Graduate Studies Ph.D. Committee (2013-16), Faculty of Graduate Studies Council (2006-08), Office of Research Services NSERC Information presenter (2009), Ph.D. committee member for Farida Orapunt (Engineering, 2008-12), Chair of M.A.Sc. defense (2015)

External Service (Last 10 Years)

Academic Service

University of Manitoba Promotion Evaluation (2012), University of Winnipeg Promotion Evaluation (2012, 15), Memorial University Promotion Evaluation (2015), Ph.D. External Examiner University of Manitoba (2011), University of Alberta (2011)

Collaboration Service

Jefferson Lab User's Group Board of Directors (2014-16), Jefferson Lab Hall C User's Steering Committee (2006-11, chair 2007-08, 09-11), Co-organizer of Jefferson Lab User's Workshop (2015,16), Co-organizer of Jefferson Lab Hall C Summer Workshop (2007, 10, 11), SHMS Detector Review (2009), Member of: Jefferson Lab User's Group (since 1990), Hall A Collaboration (since 1991), Hall C User's Group (since 1995), GlueX Collaboration (since 2002), Mainz Microtron A2 Collaboration (since 2009)

Professional Service

NSERC Subatomic Physics Long Range Planning Committee (ex-officio, 2015-16), TRIUMF Policy and Planning Advisory Committee (2015), FACETS Editorial Board (2015-present), Physics International Contributing Editor (2014-present), Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2015) International Advisory Board Member, Canadian Institute of Nuclear Physics Board of Directors (2010-13), NSERC Subatomic Physics Long Range Planning Committee (2005-06, 10-11), International Nuclear Physics Conference (INPC 2010) Hadronic Physics Convener and Program Committee Member, NSERC Subatomic Physics Evaluation Section (2007-10), TRIUMF Five Year Planning Committee (2007-08), Canadian Institute of Nuclear Physics (founding President, 2007-09), TRIUMF Working Group on Offsite Infrastructure Requirements (2006), Canadian Association of Physics Division

of Nuclear Physics (Chair, 2005-07), DNP Nuclear Physics Brief Committee (2005), DNP Session Organizer at CAP Congress (2005, 07), Referee for: British Council (2009), Canada Foundation for Innovation (2010), NSERC (2007, 11, 13), NSF (2008, 10, 13, 15), Chinese Physics Letters (2010), Journal of Physics (2011), Physics in Canada (2010), Physical Review Letters (2005, 08), Member of: American Physical Society (since 1988), Member of Canadian Association of Physicists (since 2003), member of Canadian Institute of Nuclear Physics (since 2007).

Selected Significant Research Contributions

1. Determination of the Pion Elastic Form Factor via π^+ Electroproduction Measurements at Jefferson Lab (JLab)

I am the co-spokesperson (with D. Gaskell - JLab) of an experimental program that aims to significantly improve our knowledge of the pion elastic form factor in the space-like region. Because the pion has a relatively simple *qbar-q* valence structure, this observable is of particular interest – it is one of the most direct ways of testing QCD-based models in the non-perturbative regime. Thus, it is an observable that all QCD-based calculations use as a first test case (the `positronium atom' of QCD). Using electron beams up to 5 GeV energy at JLab, we acquired data and published the first high-quality pion form factor data (with well-understood and quantified systematic uncertainties) since the seminal work of Brauel et al., at DESY, in 1979. Our data, spanning the range Q^2=0.6-2.45 GeV^2, are where theoretical calculations for F_π begin to diverge and constrain the treatment of soft versus hard contributions to the pion wave function. The five publications from this work (1a) have had continued impact, to date gathering over 800 citations (source: inspirehep.net). As a result of the impact of this work, we have received the highest possible endorsement of the JLab PAC to continue these studies with the upgraded 12 GeV electron beam at JLab (E12-06-101), including the awarding of A scientific priority in 2010, and being identified as a "high impact" experiment in a 2014 review of the JLab 12 GeV scientific program. It was also prominently featured in the 2015 NSAC Report (1b). As co-spokesperson and lead contact person, my role in all aspects of this work is significant.

2. Separated Response Function Ratios in Exclusive, Forward π^-/π^+ Electroproduction

The study of exclusive $\pi^\pm$ electroproduction on the nucleon, including separation of the structure functions, is a very useful tool in the study of hadronic structure. In contrast to inclusive (e,e') or photoproduction measurements, the transverse momentum (size) of the scattering constituent and the resolution at which it is probed can be varied independently. Furthermore, ratios of separated response functions can be formed for which nonperturbative corrections may partially cancel, yielding insight into soft-hard factorization at modest Q^2. Our results are intriguing, as the ratio of transverse cross sections $R_T=\sigma^{\pi^-}{}_T/\sigma^{\pi^+}{}_T$ suggests a transition between pion knockout and quark knockout mechanisms as the Mandelstam variable $-t$ is increased. The ratio of longitudinal cross sections $R_L=\sigma^{\pi^-}{}_L/\sigma^{\pi^+}{}_L$ is also of interest as it confirms the dominance of the pion-pole diagram at low $-t$, which is necessary for the extraction of the charged pion form factor from electroproduction data. These data were published as a Phys.Rev.Lett. in 2014, and a longer Phys.Rev.C in 2015 (2). My role in all aspects of this work is very significant, including data calibration and analysis, and manuscript preparation. This is indicated by my name being listed first (among 88 co-authors) on both publications.

3. Measurement of the Proton's Electric to Magnetic Form Factor Ratio to Q^2=8.5 GeV^2

The proton's electric to magnetic form factor ratio, G^E_p/G^M_p, was measured at JLab via the polarization transfer technique, where the ratio of the transverse and longitudinal polarization components transferred from the incident electron to the recoil proton is directly proportional to the form factor ratio. Our results

unambiguously confirm that $\mu G^E_p << G^M_p$, for $Q^2 > 2$ GeV^2, in significant contrast to measurements obtained with the 'Rosenbluth' technique (previously at SLAC and reconfirmed at JLab) that $\mu G^E_p \approx G^M_p$. This work has revolutionized our understanding of proton form factors, and has motivated many theoretical studies of proton structure (3a). After extensive studies, it is believed the source of this discrepancy is a breakdown of the single-photon exchange approximation at higher Q^2, where two-photon exchange effects skew the extraction of the proton form factors in the Rosenbluth technique, but do not significantly affect the polarization transfer technique. Our top five papers (3b) have accrued over 2000 citations to date (source: inspirehep.net), and our results are now shown in some particle physics textbooks (3c). In addition to my contributions to the running and interpretation of these experiments, my post-doctoral fellow (Dr. Cornel Butuceanu) assisted as Run Coordinator of the higher Q^2 experiment.

References

(1a) Phys. Rev. C **78**, 045202; Phys. Rev. C **78**, 045203; Phys. Rev. C **75**, 05505; Phys. Rev. Lett. **97,** 192001; Phys. Rev. Lett. **86,** 1713
(1b) Nuclear Science Advisory Committee, "The 2015 Long Range Plan for Nuclear Science'", October 2015, pp 14-16. http://science.energy.gov/~/media/np/nsac/pdf/2015LRP/2015_LRPNS_091815.pdf
(2) Phys. Rev. Lett. **112**, 182501; Phys. Rev. C **91**, 015202
(3a) For a recent review, see: Eur. Phys. J. A**51**, 79
(3b) We have more recent papers arising from this work, but the older ones have accrued more citations and are: Phys. Rev. Lett. **104**, 242301; Phys. Rev. C **71**, 055202; Phys. Rev. Lett. **88**, 092301; Phys. Rev. C **65**, 038202; Phys. Rev. Lett. **84**, 1398
(3c) An example textbook is: E.M. Henley, A. Garcia, "Subatomic Physics", 3rd ed. (2007)

List of Recent Publications

44 papers published in peer reviewed journals over the past 10 years. Only a selection of the most recent works are listed here. You can find the full list at: http://inspirehep.net/search?p=find+a+huber,+g.m.

Selected Publications

118) M. Dieterle, et al., ``Photoproduction of π^0-pairs off protons and off neutrons'', Eur. Phys. J. A **15** (2015) 142 1-18, arXiv:1510.09167.

117) C. Fannelli, et al., ``Polarization Transfer in Wide-Angle Compton Scattering and Single-Pion Photoproduction from the Proton'', Phys. Rev. Lett. **115** (2015) 152001 1-6, arXiv:1506.04045 [nucl-ex].

116) S. Schumann, et al., ``Threshold π^0 Photoproduction on Transversely Polarized Protons at MAMI'', Phys. Lett. B **750** (2015) 252-258.

115) P. Adlarson, et al., ``Measurement of π^0 photoproduction on the proton at MAMI-C'', Phys. Rev. C **92** (2015) 024617 1-12, arXiv:1506.08849 [hep-ex].

114) A. Kaeser, et al., ``The isospin structure of photoproduction of $\pi\eta$ pairs from the nucleon in the threshold region'', Phys. Lett. B **748** (2015) 244-250.

113) J. Annand, et al., ``First measurement of target and beam-target asymmetries in the $\gamma p \rightarrow \pi^0 \eta p$ reaction'', Phys. Rev. C **91** (2015) 055208 1-9.

112) M. Martemianov, et al., ``A new measurement of the neutron detection efficiency for the NaI Crystal Ball detector'', IOP Journal of Instrumentation **10** (2015) T04001 1-11, arXiv:1502.07317.

111) P.P. Martel, et al., ``Measurements of Double-Polarized Compton Scattering Amplitudes and Extraction of the Proton Spin Polarizabilities'', Phys. Rev. Lett. 114 (2015) 112501 1-5, arXiv:1408.1576 [nucl-ex].

110) G.M. Huber, et al., ``Separated Response Functions in Exclusive, Forward $\pi^{\pm}$ Electroproduction on Deuterium'', Physical Review C **91** (2015) 014202 1-23, arXiv:1412.5140 [nucl-ex].

109) S. Costanza, et al., ``Helicity dependence of the γ^3He$\rightarrow\pi$ X reactions in the Δ(1232) resonance region'', Eur. Phys.l J. A **50** (2014) 173 1-13.

108) C.S. Akondi, et al., ``Measurement of the transverse target and beam-target asymmetries in η meson photoproduction at MAMI'', Phys. Rev. Lett. **113** (2014) 102001 1-5, arXiv:1408.3274 [nucl-ex].

107) D. Werthmueller, et al., ``Quasifree Photoproduction of η Mesons off Protons and Neutrons'', Phys. Rev. C **90** (2014) 015205 1-21, arXiv:1407.6974 [nucl-ex].

106) W. Li, G.M. Huber, ``Optical characterization of RTV615 silicone rubber compound'', IOP Journal of Instrumentation **9** (2014) P07012 -12, arXiv:1407.3258 [physics.ins-det].

105) G.M. Huber, et al., ``Separated Response Function Ratios in Exclusive Forward $\pi^{\pm}$ Electroproduction'', Phys, Rev. Lett. **112** (2014) 182501 1-6, arXiv:1404.3985 [nucl-ex].

104) M. Dieterle, et al., ``Photoproduction of π^0-mesons off neutrons in the nucleon resonance region'', Physical Review Letters **112** (2014) 142001 1-6, arXiv:1403.2617 [nucl-ex].

Selected Technical Reports

C. Butuceanu, G.M. Huber, H.P. Blok, D. Gaskell, T. Horn, ``π-/π+ Separated Response Functions Ratios in Forward Pion Electroproduction on Deuterium at Q^2=0.6-2.45 GeV^2 and -t=0.1-0.4 GeV^2'', HallC-doc-773-v1, 2014

W. Li, et al., ``HGC Mirror Reflectivity Measurement'', HallC-doc-741-v1, 2012

A. Fischer, G.M. Huber, ``Performance Testing of 5 inch PMTs'', HallC-doc-738-v1, 2012

W. Li, G.M. Huber, D. Gervais, L. Sichello, K. Wolbaum, ``Mirror Testing Result'', HallC-doc-716-v2, 2012

External Research Funding (Last 6 Years)

Title of Proposal, Applicant Names	**Funding Source**	**Average $/year**	**Dates, status**
Studies of Hadronic Stucture using Electromagnetic Probes, G.M Huber	NSERC Subatomic Physics Individual Discovery Grant	$169,230	2016-2021, under review
SoLID Heavy Gas Cherenkov Detector Prototype, G.M. Huber	CFI J. Evans Leader's Fund	$99,960	2016, under review
Investigating Hadron Structure with CB-TAPS at MAMI, D. Hornidge (PI), G.M. Huber, A. Sarty	NSERC Subatomic Physics Project Grant	$143,333	2015-2018 awarded
Investigating Hadron Structure with CB-TAPS at MAMI, D. Hornidge (PI), G.M. Huber, A. Sarty	NSERC Subatomic Physics Project Grant	$110,000	2012-2015 completed
Studies of Hadron Structure using Electromagnetic Probes, G.M Huber	NSERC Subatomic Physics Individual Discovery Grant	$56,400	2011-2016 awarded
Heavy Gas Cherenov Detector for Jefferson Lab, G.M Huber	NSERC Subatomic Physics RTI-1	$125,000	2010-2012 completed

Nikolay Kolev
Lecturer
kolev20n@uregina.ca, (306) 585-4262

Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Solid State Physics	University of Houston	2003
B.Sc.	Particle and nuclear Physics	Sofia University	1994

Employment History

Employer	Position Title	Period
University of Regina	Lecturer	2007 – present
University of Regina	Sessional Lecturer, Research Associate	2003 – 2007
Bulgarian Academy of Sciences	Research Associate	1994 – 1998

Teaching History (Last 10 Years)

Course	Title	Years Taught
PHYS 109 Lab	General Physics I Lab	2006
PHYS 109	General Physics I	2008, 09, 10, 11, 12, 13, 14
PHYS 119	General Physics II	2007, 08, 09, 10, 11, 12, 13, 14, 15
PHYS 261	Heat and Thermodynamics	2007, 08, 09, 10, 11, 12, 13
CS 315	Introduction to Computer Graphics	2014
PHYS 322	Physical Optics and Electromagnetic Radiation	2008
PHYS 342	Atomic Physics	2012, 13, 14, 15
PHYS 351	Mathematical Physics I	1010, 11, 12, 13, 15
PHYS 362	Statistical Mechanics	2006, 07, 08, 09, 10, 11, 12, 13, 15
PHYS 401	Quantum Mechanics I	2008, 09, 10, 11, 12
PHYS 411	Advanced Classical Mechanics	2008
PHYS 421	Solid State Physics	2007

Student and Post-Doctoral Supervision

Name	Position	Dates of Supervision	Current Employment
Postdoctoral & Relevant Trainees			
N/A			
Graduate Students			
N/A			
Undergraduate Students			
Potter, Gabriel	Honours Student	September 2007 – April 2008	

University Service (Last 10 Years)

Department of Physics Service

Curriculum committee member: 2013 – present.

Coop coordinator: 2015 – present.

Faculty of Science Service

Other UofR Service

Member of URFA executive committee: 2012 – 2014 and 2015 – present.

Member of URFA internal management committee: 2013 -2014.

External Service (Last 10 Years)

Academic Service

Discipline/Collaboration Service

Professional Service

CAP Member.

Outreach/Community Service

Regional Science Fair judge (annualy).

Member at large of the board of the Saskatchewan Scholastic Chess Association.

Significant Research and Teaching Contributions (Last 10 Years)

1. Participated in analysis of a phenomenological supersymmetric dark matter model with cosmological applications for LHC physics. Paper (17 citations):

" Indirect measurements of the stau-neutralino1 mass difference and gluino mass in the co-annihilation region of mSUGRA models at the LHC", R.Arnowitt, B. Dutta, T. Kamon, N. Kolev, P. Simeon, D. Toback, P. Wagner, Phys. Lett. B 649, 1, 73-82 (2007).

2. Participated in the development and application to a practical problem a bi-event subtraction technique for jets in hadron colliders. Paper (11 citations):

"Bi-Event Subtraction Technique at Hadron Colliders", B. Dutta, T. Kamon, N. Kolev and A Krislock, Phys. Lett. B 703, 4, 475-478 (2011).

3. Consistently applied the active learning approach to introductory physics and other classes. This included development of worksheets for class exercises, development of class demonstrations for these exercises. The results were encouraging in terms of student evaluations and student engagement.

List of Recent Publications (Last 10 Years)

8 papers in refereed journals with 141 citations.

Publications

B. Dutta, Y. Gao, T. Ghosh, T. Kamon, N. Kolev, “Explaining the CMS dilepton mass endpoint in the NMSSM”, Physics Letters B 749 (2015) 326.

B. Dutta, T. Kamon, N. Kolev, K. Sinha, K. C. Wang, S. Wu, “Top squark searches using dilepton invariant mass distributions and bino-Higgsino dark matter at the LHC”, Physical Review D 87 (2013) 095007.

B. Dutta, T. Kamon, N. Kolev, K. Sinha, and K. Wang, “Searching for top squarks at the LHC in fully hadronic final state”, Physical Review D 86 (2012) 075004.

B. Dutta, T. Kamon, N. Kolev, A. Krislock, “Bi-event subtraction technique at hadron colliders”, Physics Letters B 703 (2011) 475.

B. Dutta, T. Kamon, A. Krislock, N. Kolev, and Y. Oh, “Determination of non-universal supergravity models at the Large Hadron Collider”, Physical Review D 82 (2010) 115009.

R. Arnowitt, B. Dutta, T. Kamon, N. Kolev, P. Simeon, D. Toback, P. Wagner, “Indirect measurement of the stau-neutralino1 mass difference and gluino mass in the co-annihilation region of mSUGRA models at the LHC”,Phys. Lett. B 649 (2007) 73.

M. Iliev, A. Litvinchuk, V. Hadjiev, Y.-Q. Wang, J. Cmaidalka, R.-L. Meng, Y.-Y. Sun, N. Kolev, M. Abrashev, “Raman spectroscopy of low-temperature Pnma and high-temperature R3c phases of $LaCrO_3$”, Phys. Rev. B 74 (2006) 214301.

R. Arnowitt, B. Dutta, T. Kamon, N. Kolev, D. Toback, “Detection of SUSY in the stau-neutraluino co-annihilation region at the LHC”, Phys. Lett. B 639 (2006) 46.

Proposals – approved

Technical Reports

External Research Funding (Last 6 Years)

Investigator(s)	Grant Title/Subject	Amount per year	Years of Tenure
N/A			

George J. Lolos

Professor of Physics
George.Lolos@uregina.ca, (306) 585-4248

Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Nuclear Physics (Intermediate Energy Physics)	UofR	1979
M.Sc.			
B.Sc.	Ptychio in Physics with Research Component	University of Athens	1973

Employment History

Employer	Position Title	Period
McGill University	Post doctoral Fellow	1978-1979
UBC/TRIUMF	Research Associate	1979-1983
INFN/Lecce (Italy)	Director of the Intermediate Energy Research Group	1993-1994
University of Regina	Faculty	1983-2016

Teaching History (Last 10 Years)

Course	Title	Years Taught
PHYS 111	Mechanics (Calculus based)	PHYS 111
PHYS 261	Heat and Thermodynamics	PHYS 261
PHYS 292	Fluid Mechanics	PHYS 292
PHYS 342	Atomic Physics	PHYS 342
PHYS 442	Introduction to Ementary Particle Physics	PHYS 442
PHYS 833	Direct Nuclear Reaction Theory	PHYS 833
PHYS 834	Intermediate Energy Nuclear Physics	PHYS 834

Student and Post-Doctoral Supervision (Last 6 years)

Name	Position	Dates of Supervision	Current Employment
Postdoctoral & Relevant Trainees			
Semenov, A.	Research Scientist	Apr, 2007 - present	UofR
Semenova, I.	Research Assistant	Apr, 2007 - present	UofR
Graduate Students			
Foda, A.	Ph.D. student	Sep, 2014 – present	UofR
Ochoa, N.	Ph.D. student	Sep, 2014 – present	UofR
Beattie, T.	Ph.D. student	Jan, 2014 – present	UofR
Fortun-Stoker, J.	M.Sc. student	Sep 2013 – Aug 2015	Research Assistant - UofR
Krueger, S.	M.Sc. student	Sep 2012 – July 2014	iQMetrix (Software)
Tahani, M.	M.Sc. student	May 2010 – July 2012	UofC PhD AstroPhys
Katsaganis, S.	M.Sc. student	Sep 2007 – May 2011	UofR PhD in CS
Janzen, K.	M.Sc. student	Sep 2007 – May 2010	CLS Macromolecular
Leverington, B.	Ph.D. student	Sep 2004 – Apr 2010	U Heidelberg - LHCb
Undergraduate Students			
Gryba, S.	B.Sc. Undergraduate Researcher	May-Aug, 2015	UofR
Henschel, C.	B.Sc. Undergraduate Researcher	May-Aug, 2015	UofR
Gryba, S.	Applied Physics (Honours) Project Advisor	May-Aug, 2014	UofR
Teigrob, T.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
Singh, M.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
La Posta, M.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
Beattie, T.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
Horvath, Z.	B.Sc. Undergraduate Researcher	May-Aug, 2013	UofR
Teigrob, L.	B.Sc. Undergraduate Researcher	May-Aug, 2013	UofR
Plus 20 other undergraduates since 2009 on BCAL Construction			

University Service (Last 10 Years)

Department of Physics Service

Departmental Curriculum Committee (member and chair); Faculty of Science Faculty Review Committee (member and chair); Graduate Student Coordinator; Acting Head; Physics Lab Instructor search committee (member).

Faculty of Science Service

Faculty of Science Faculty Review Committee (member and chair); Admissions and Studies Committee (member); FGS&R Ph.D. Committee (member).

Other UofR Service

UofR Representative to the TRIUMF Board of Management; Director P3I; Council Agenda Committee (member); External Examiner (M.Sc. in Engineering, M.Sc. in Biology); Executive of Council (member).

External Service (Last 10 Years)

Academic Service

PhD Thesis External Examiner for the UofA; Promotion and Tenure Committee (University of Thessaloniki); Promotion application reviewer (University of Indiana, University of Athens);); Promotion application reviewer for JLab; Ph.D. Committee member for two Physics students.

Discipline/Collaboration Service

GlueX Deputy Spokesman; GlueX Collaboration Board (Chair and member); Journal Publication Reviewer (PRL, PL and NIM A)

Professional Service

SURA Fellowship Committee (member); APS and CAP (member)

Outreach/Community Service

Series of Particle Physics seminars to SIAST; Several TV interviews on GlueX physics; an average of three calls by the public on physics-related topics.

Significant Research Contributions (Last 6 Years)

My own role on the UofR effort within GlueX was focused in **initiating** the long R&D effort, in the writing **of all** the proposals for funding to Jlab/DOE, on the numerous presentations to the GlueX Collaboration and to all the DOE-mandated review committees and, generally, acting as the driver of the project, including my participation in the writing of the final procurement specifications for all the BCAL components (SciFi's and SiPM's) that led to the contract awarded. I also led the effort in procuring all the necessary equipment to create a laboratory where the testing of the several series of generations of

SiPM's could be performed and they could be characterized. I co-supervised (with Drs. Papandreou and Semenov) the work done by a series of graduate and undergraduate students that did their projects on the SiPM's in the references (1-4) listed below:

1) **T.D. Beattie *et al***., "*Methodology for the Determination of the Photon Detection Efficiency of Large-Area Multi Pixel Photon Counters*" **IEEE Transactions of Nuclear Science, Vol. 62, No. 4, (2015) 1865-1872.**

This article describes the methodology used and the photo-efficiency results of actual production-version SiPM's to be used as the BCAL read-out. The method is unique, among several similar methods with published results, in that the scintillation light incident on the SiPM's is that of the actual scintillating fibers (SciFi) used in the BCAL and the SiPM response is the result of the actual spectral response of the fibers.

2) **E.G. Anassontzis *et al***., *"Relative Gain Monitoring of the GlueX Calorimeters"* **NIM A 738 (2014) 41-49"**.

My own "specific contributions" to this effort, in addition to the long discussions with the Athens /GlueX group and the testing of various options under consideration through several years of efforts, was the idea to "flash" the BCAL light-guides with LED's in such a way as to illuminate both ends simultaneously. This allows an independent monitoring of the LED's, their power supplies and any variations of light output due to possible individual LED variations. In addition, this method provides a "chronology" of possible SciFi degradation due to radiation damage or other environmental factors.

3) **T.D. Beattie *et al***., *"Light yield of Kuraray SCSF-78MJ scintillating fibers for the GlueX Barrel Calorimeter"* **NIM A 767 (2014) 245-251".**

This paper describes the quality control analysis of the SciFi's used in the construction of the BCAL. It established the statistically significant uniformity of response among the different batches of SciFi's and documented that variations in light output do not affect the quality of readout as laid in the specifications for procurement.

4) **A. Baulin *et al.*,** *"Attenuation length and spectral response of Kuraray SCSF-78MJ scintillating fibres*" **NIM A 715 (2013) 48-55**.

This instrumentation paper reports the results of the testing performed on the successful candidate SciFi's for the BCAL. The specifications, as laid out by JLab, were demanding on the quality of attenuation length and spectral response. The former in order to assure the maximization of produced scintillation photons that reach the SiMP's and the latter that the response of the SiPM's does not change due to variations in emission spectra of the

SciFi's.

5) **G.M. Huber *et al***., *"Separated Response Function Ratios in Exclusive, Forward π± Electroproduction"* **PRL 112 (2014) 182501-5.**

The transition from non-perturbative to perturbative description of nucleons and mesons is of great interest in subatomic physics. The p, in particular, is perhaps the most attractive subject of such studies due to its "structural" simplicity of a quark-antiquark pair and because perturbative QCD predicts a definitive value - at the asymptotic limit Q. → ∞ - of the p form factor. In the pursuit of a reliable extraction of the latter at several values of four-momentum transfer, an accurate determination of the ratios of the longitudinal cross sections for the two charged p states is necessary. The ratios of the separated cross-sections for the two charged p states may show the transition to perturbative QCD at lower momentum and energy transfer values than the individual (unseparated) cross-sections will. This paper is the result of a series of pioneering measurements at JLab that has led to more of such measurements after the JLab energy Upgrade. The upcoming measurements hold promise for this important transition region between non-perturbative and perturbative QCD.

List of Recent Publications (Last 6 Years)

131. "**Methodology for the Determination of the Photon Detection Efficiency of Large-Area Multi-Pixel Photon Counters"** Beattie, T. *et al*., IEEE Transactions on Nuclear Science, Vol. **62**, No. 4, (2015) 1865-1872.

130. ***"Separated response functions in exclusive, forward π± electroproduction on deuterium"*** *G. M. Huber* et al. *(Jefferson Lab F_π Collaboration) PR* ***C 91*** *015202 (2015).*

129. **"Light yield of Kuraray SCSF-78MJ scintillating fibers for the Gluex barrel calorimeter"** Beatie. T. *et al*., NIM **A767** (2014) 245-251.

128. "**Separated Response Function Ratios in Exclusive, Forward π· Electroproduction"** G.M. Huber *et a*l. (Jefferson Lab F_π Collaboration), PRL **112** 182501 *2014).

127. **"Relative gain monitoring of the GlueX calorimeters"** E.G. Anassontzis *et al.*, NIM **A738** (2014) 41-49.

126. "**Attenuation length and spectral response of Kuraray SCSF-78MJ scintillating fibres"** A.E. Baulin[1] *et a*l., NIM **A715** (2013) 48–55.

125. **"Measurement of K^- p radiative capture** to $\gamma\Lambda$ **and $\gamma\Sigma^0$ for p(K^-) between 514 and 750 MeV/c"** S. Prakhov *et al*., , Phys. Rev. C **82**, (2010) 015201.

124. **"Measurement of $\Lambda\pi^0$, K^0n, and $\Sigma^\circ\pi^0$ production in K^-p interactions for pK^- between**

514 and 750 MeV/*c*" S. Prakhov *et al*., Phys. Rev. C **80**, (2009) 025204.

123. **"Virtual Compton scattering and neutral pion electroproduction in the resonance region up to the deep inelastic region at backward angles"** G. Laveissière et al., Phys. Rev. C **79**, (2009) 015201.

122. "**Measurement of the total cross section of the reaction $K^- p^0$ between 514 and 750 MeV/*c*"** T. D. S. Stanislaus *et al*., Phys. Rev. C **79**, (2009) 015203.

External Research Funding (Last 6 Years)

Investigator(s)	Grant Title/Subject	Total Amount	Years of Tenure
Papandreou, Z. & 1 other	NSERC Discovery Grant	$405,000	2015-2018
Babyn, P. (UofS) & 17 others (ZP was the UofR PI)	Sylvia Fedoruk Program Grant	$5,166,444 (total) $1,450,00 to UofR	2015-2019
Papandreou, Z. & 2 others	NSERC Engage Grant	$25,000	2014
Papandreou, Z. & 3 others	Canadian Centre for Nuclear Innovation Grant	$118,430	2013-2015
Lolos, G.J and Papandreou, Z.	NSERC Project Grant	$432,000	2012-2015
Papandreou, Z. and Lolos, G.J.	JLab/DOE Grant	$1,468,400	2009-2012
Papandreou, Z. and Lolos, G.J.	JLab/DOE Grant	$52,500	2009
Lolos, G.J and 2 others	NSERC Project Grant	$620,000	2009-2012

Nader Mobed

Professor of Physics
nader.mobed@uregina.ca, (306) 585 4359

Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Theoretical Nuclear Physics	McGill University	1984
M.Sc.	Experimental Nuclear Physics	McGill University	1979
B.Sc.	Physics	Pahlavi University	1977

Employment History

Employer	Position Title	Period
University of Regina	Faculty	1989 – Present
TRIUMF Theory Group	Research Associate	1988
University of Alberta	Postdoctoral Fellow	1986 - 1988
University of Toronto	Postdoctoral Fellow	1984 - 1986
University of Regina	Associate Dean (Academic), Faculty of Science	2009 - Present
University of Regina	Head of Physics	2013 - Present
University of Regina	Head of Mathematics and Statistics	2007 - 2009

Teaching History (Last 10 Years)

Course	Title	Years Taught
PHYS 109	General Physics I	2006
PHYS 202	Classical Mechanics I	2009

PHYS 351	Mathematical Physics I	2006
PHYS 362	Statistical Mechanics	2014
PHYS 401	Quantum Mechanics I	2007
PHYS 411	Advanced Classical Mechanics	2015, 14, 13
PHYS 491 AA/402	Quantum Mechanics II	2014, 06
PHYS 801	Advanced Quantum Mechanics	2012, 11, 10, 08
PHYS 803	Quantum Field Theory I	2015, 12, 10, 08
PHYS 805	Quantum Field Theory II	2006
PHYS 831	Theoretical Nuclear Physics	2007
PHYS 835	Elementary Particles	2013

Student and Post-Doctoral Supervision

Name	Position	Dates of Supervision
Singh, Dinesh	Postdoctoral Research Associate	2005 - 2013
Petry, Robert	Ph.D. student (Co-supervisor)	2005 - 2010
Vedadi, Mohammad	M.Sc. student (Co-supervisor)	2004-2006
Wagaye, Abrha	M.Sc. Student (Co-supervisor)	2010 -2011
Urichuk, Andrew	B.Sc. Honours Project	2012

University Service (Last 10 Years)

Department of Physics Service

Department Head, Undergraduate Coordinator, Member of the Curriculum Committee, Physics Representative on the Library Committee.

Faculty of Science Service

Associate Dean (Academic), Head of Mathematics and Statistics, Member of the Search Committee for a CRC in Computer Science.

Other UofR Service

External Examiner for 24 Master's Theses in Engineering; Mathematics, Chemistry, and Education (2006 – present); Served on 11 Ph.D. and 5 M.Sc. Thesis Committees in Physics, Mathematics, Chemistry, and Engineering (2006 – Present); Chaired 6 Ph.D. and 25 M.Sc. thesis defenses (2006 –Present); Representative on the University of Saskatchewan College of Medicine Admissions Committee (2009 - 2015); Science Representative on the Advisory Committee on Copyright (2012 – Present); Member of Search Committees to hire 8 Faculty Members in Nursing (2009 – 2014), 3 Faculty Members in Engineering and Applied Science (2015), and the search Committee to select a new Academic Associate Dean for the Faculty of Engineering and Applied Science (2014).

External Service (Last 10 Years)

Professional Service

CAP Member, APS Member, Journal Referee (Annals of Physics, Modern Physics Letters A, Galaxies, Canadian Journal of Physics)

Outreach/Community Service

Speaker and a Member of Discussion Panel at the Science and Mathematics Teachers of Saskatchewan Conference, *Sciematics 2013*; Member of the Executive Committee for *Sciematics 2015* held at the Judge; Regina Regional Science Fair (annually)

Significant Research Contributions (Last 10 Years)

Path Integral Formalism in Curved Spacetime [1]

The Feynman path integral approach to quantum mechanics is an important perspective in theoretical physics for description of a broad range of phenomena in particle physics, statistical mechanics, and other areas. Its conceptual value comes from naturally describing classical and quantum phenomena under a consistent mathematical structure, with the additional capacity to explore quantum particle interactions in the presence of a classically curved space-time background. We propose an extension of the conventional path integral formalism into a locally curved space-time setting by using either Fermi or Riemann normal co-ordinates. We find that while local time translation is strictly non-unitary due to local space-time curvature contributions, the resulting scalar propagator recovers the expected Lagrangian for free-particle propagation, plus additional terms that correspond to both time reversal symmetry breakdown and a quantum violation of the weak equivalence principle at the Compton wavelength scale of the particle. It would be very interesting to explore possible connections between the time-reversal symmetry breakdown due to non-unitary time evolution of the system and the observed violation of the time-reversal symmetry in interactions of elementary particles. An understanding of the quantum violation of the equivalence principle is of great interest as it may provide an insight to formulate a consistent theory of quantum gravity.

[1] D. Singh, N. Mobed, Mod. Phys. Lett. A27 (2012) 1250065.

Tidal Dynamics in Cosmological Spacetimes [2]

For local systems, such as the solar system, each body is subject to the gravitational influence of the whole mass–energy content of the universe; therefore, the relative motion of bodies is only affected by the tidal acceleration of the cosmic gravitational field. A major objective of this work is to study the general features of tidal dynamics in certain spherically symmetric cosmological models. Particular emphasis has been placed on inhomogeneous models, since spatial inhomogeneities can mimic dark energy in the luminosity distance–redshift relation; moreover, inhomogeneous cosmological models are of current interest as possible alternatives to the dark-energy models. We have investigated the influence of inhomogeneities on tidal dynamics in the simple models that were considered in this work. The results could therefore be of interest in the theoretical study of the tidal evolution of galaxies. Our results also indicate that solar-system anomalies cannot be explained in terms of cosmological perturbations based upon the general relativistic cosmological models considered in the present work.

[2] B. Mashhoon, N. Mobed, D. Singh, Class. Quantum Grav. 24 (2007) 5031.

List of Recent Publications (Last 10 Years)

D. Singh, **N. Mobed**, “Path Integrals in Curved Spacetime”, Can. J. Phys. 91 (2013) 491.

D. Singh, **N. Mobed**, “A New Perspective on Path Integral Quantum Mechanics in Curved Spacetime”, Mod. Phys. Lett. A27 (2012) 1250065.

D. Singh, **N. Mobed**, “Local Space-Time Curvature Effects on Quantum Orbital Angular Momentum”, Class. Quantum Grav. 28 (2011) 105024.

D. Singh, **N. Mobed**, “Is There an Observable Limit to Lorentz Invariance at the Compton Wavelength Scale?”, Gen. Rel. Grav. 42 (2010) 1707.

D. Singh, **N. Mobed**, “Breakdown of Casimir Invariance in Curved Space-Time”, Annalen Phys. 552 (2010) 555.

D. Singh, **N. Mobed**, P. Ouimet, “Signatures of Noncommutative Geometry in Muon Decay for Nonsymmetric Gravity”, Found. Phys. 40 (2010) 1789.

D. Singh, **N. Mobed**, “Effects of Spacetime Curvature on spin-1/2 Particle Zitterbewgung”, Class. Quantum Grav. 26 (2009) 185007.

D. Singh, **N. Mobed**, “Breakdown of Lorentz Invariance for Spin-1/2 Particle Motion in Curved Space-Time with Applications to Muon Decay”, Phys. Rev. D79 (2009) 024026.

B. Mashhoon, **N. Mobed**, D. Singh, " Tidal Dynamics in Cosmological Spacetimes", Class. Quantum Grav. 24 (2007) 5031.

D. Singh, **N. Mobed**, "The Implications of Noninertial Motion on Covariant Quantum Spin", Class. Quantum Grav. 24 (2007) 2453.

D. Singh, **N. Mobed**, G. Papini, "Can gravity distinguish between Dirac and Majorana neutrinos?", Phys. Rev. Lett. 97 (2006) 041101; 98 (2007) 69002.

D. Singh, **N. Mobed**, G. Papini, "Neutrino wave packet propagation in gravitational fields", Phys. Lett. A351 (2006) 373.

External Research Funding (Last 10 Years)

N/A.

Pierre-Philippe Ouimet

Lecturer
pierre-philippe.ouimet@uregina.ca, (306) 337-2238

Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Theoretical Particle Physics	University of Regina	2005
M.Sc.			
B.Sc.	Physics (Honors)	University of Alberta	1998

Employment History

Employer	Position Title	Period
University of Regina	Tenured Lecturer	07/2009-present
University of Regina	Tenure-track Lecturer	07/2008-06/2009
University of Regina	Term Lecturer	08/2005-06/2008

Teaching History (Last 10 Years)

Course	Title	Years Taught
PHYS 109	General Physics I	2005, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15
PHYS 111	Mechanics	2005
Physics 112	Waves and Optics	2005, 06, 07
Physics 119	General Physics II	2006, 07, 08, 09, 14, 15
Physics 142	From Quarks to the Cosmos	2009, 11, 12, 13
Physics 202	Classical Mechanics I	2007, 08, 10, 11, 12, 13, 14, 15
Physics 301	Classical Mechanics II	2006, 07, 09, 10, 11, 12, 13, 14, 15
Physics 352	Mathematical Physics II	2008, 09, 10, 11, 12, 13, 14, 15

Physics 401	Quantum Mechanics I	2013, 14, 15
Physics 411	Advanced Classical Mechanics	2011, 12

Student and Post-Doctoral Supervision

Name	Position	Dates of Supervision	Current Employment
Postdoctoral & Relevant Trainees			
Graduate Students			
Undergraduate Students			
Thomas Fitz-Gerald	Honors Project Advisor	Jan, 2014- Feb, 2015	NA
Shayne Gryba	Honors Project Advisor	Sept, 2015 – present	University of Regina

University Service (Last 10 Years)

Department of Physics Service

November 2012: Member of a departmental search committee struck to fill a Tenure Track Lecturer position in Physics.

May 2009 to September 2009: Member of a departmental search committee struck to fill an open term position for a Physics Lab Instructor.

Winter 2007 to present: Member of the department of Physics outreach committee.

Committee member for MSc student Wenliang Li. Student defended on September 17, 2012.

Committee member for MSc student Stamatis Katsaganis. Student defended on March 8, 2011.

Committee member for MSc student Shaun Szymanski. Student defended on April 16, 2010.

Faculty of Science Service

August 31, 2015: MSc defense chair in Biology

April 7, 2014: MSc defense chair in Math.

Fall 2012 to present: Science Representative to Campion College Faculty Forum.

November 2012: External member of a Chemistry department search committee struck to fill a Tenure track Lecturer position in Chemistry.

July to December 2012: Member of Science Student Appeals Committee.

November 11, 2011: MSc defense chair in Chemistry

Fall 2009 to Fall 2011: Member of the Faculty of Science Laboratory Instructor review committee.

Fall 2007 to present: Member of an ad hoc faculty/university committee struck to develop a science class (Science 120) to serve the needs of education students.

Other UofR Service

Winter 2013 to present: Member of the Council Budget Committee.

Winter 2013 to Fall 2013: Member of the Special Committee of Council struck to revise University Council's rules and regulations.

External Service (Last 10 Years)

Outreach/Community Service

May 2013 to present: Local Chief Judge for the 2017 National Science Fair.

March 2010 to present: Chief Judge for the Regina Regional Science Fair.

October 2009 to March 2010: Member of the organizing committee for the Regina Regional Science Fair.

2005 to 2009: Volunteer judge at the Regina regional science fair (one evening every year).

Significant Research Contributions (Last 6 Years)

Dinesh Singh, Nader Mobed & **Pierre-Philippe Ouimet**. 2010. Signatures of Noncommutative Geometry in Muon Decay for Nonsymmetric Gravity. Foundations of Physics 40: 1789-1799, 2010. We attempted to model potential quantum gravitational effects using the mathematics of noncommutative geometry in a nonsymmetrical gravitational theory to see if any could be observed in a muon decaying while orbiting a black hole. This work was build on a previous publication by N. Mobed and D. Singh where they had looked at the system from the standpoint of QFT in a curved space-time. My contributions were in how to implement noncommutative geometry in their previous approach and in the interpretation of the resulting numerical data.

List of Recent Publications (Last 6 Years)

Publications

Dinesh Singh, Nader Mobed & **Pierre-Philippe Ouimet**. 2010. Signatures of Noncommutative Geometry in Muon Decay for Nonsymmetric Gravity. Foundations of Physics 40: 1789-1799, 2010.

Zisis Papandreou
Professor of Physics
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Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Nuclear Physics	UofR	1989
M.Sc.			
B.Sc.	Physics (Honours)	UofR	1984

Employment History

Employer	Position Title	Period
U of Regina	Professor	7/2004-present
U of Regina	Associate Professor	7/1998-6/2004
U of Regina	Assistant Professor	7/1995-6/1998
George Washington U.	Assistant Professor	2/1993-6/1995
Utrecht University	Post Doctoral Fellow	4/1990-1/1993

Teaching History (Last 10 Years)

Course	Title	Years Taught
PHYS 112	Waves and Optics	2008, 09, 10, 11, 12, 13, 14, 15
PHYS 261	Heat and Thermodynamics	2014, 15
PHYS 301	Classical Mechanics II	2005, 08
PHYS 319	Health Physics	2010, 11, 12, 13, 14, 15
PHYS 372	Modern Experimental Physics	2006, 07, 08, 09, 10, 11, 12, 13
PHYS 890AZ	Photosensors for Nuclear Imaging	2014

Student and Post-Doctoral Supervision (Last 6 years)

Name	Position	Dates of Supervision	Current Employment
Postdoctoral & Relevant Trainees			
Semenov, A.	Research Scientist	Apr, 2007 - present	UofR
Semenova, I.	Research Assistant	Apr, 2007 - present	UofR
Graduate Students			
Foda, A.	Ph.D. student	Sep, 2014 – present	UofR
Ochoa, N.	Ph.D. student	Sep, 2014 – present	UofR
Beattie, T.	Ph.D. student	Jan, 2014 – present	UofR
Fortun-Stoker, J.	M.Sc. student	Sep 2013 – Aug 2015	Research Assistant - UofR
Krueger, S.	M.Sc. student	Sep 2012 – July 2014	iQMetrix (Software)
Tahani, M.	M.Sc. student	May 2010 – July 2012	UofC PhD AstroPhys
Katsaganis, S.	M.Sc. student	Sep 2007 – May 2011	UofR PhD in CS
Janzen, K.	M.Sc. student	Sep 2007 – May 2010	CLS Macromolecular
Leverington, B.	Ph.D. student	Sep 2004 – Apr 2010	U Heidelberg - LHCb
Undergraduate Students			
Gryba, S.	B.Sc. Undergraduate Researcher	May-Aug, 2015	UofR
Henschel, C.	B.Sc. Undergraduate Researcher	May-Aug, 2015	UofR
Gryba, S.	Applied Physics (Honours) Project Advisor	May-Aug, 2014	UofR
Teigrob, T.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
Singh, M.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
La Posta, M.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
Beattie, T.	B.Sc. Undergraduate Researcher	May-Aug, 2014	UofR
Horvath, Z.	B.Sc. Undergraduate Researcher	May-Aug, 2013	UofR
Teigrob, L.	B.Sc. Undergraduate Researcher	May-Aug, 2013	UofR
Plus 20 other undergraduates since 2009 on BCAL Construction			

University Service (Last 10 Years)

Department of Physics Service

Undergraduate Student Councilor, Graduate Student Coordinator, Co-Op Committee (Member), Outreach Committee (Chair), Curriculum Committee (Ad hoc Member), Departmental, Acting Department Head, Physics Faculty Search Committee (Chair), Physics Lecturer Search Committee (Member), Web and Social Media Manager

Faculty of Science Service

Physics Admin Assistant Search Committee (Member), Distance and Distributed Learning Committee (Member), Faculty Graduate Coordinators Committee (Member), Dean of Science Search Committee (Member), Faculty of Science Budget and Space Committee (Member), Faculty of Science Representative to other Faculties (Kinesiology & Health Studies, Education)

Other UofR Service

Executive of Council (Elected Member), Prairie Particle Physics Institute (Deputy Director), Faculty of Graduate Studies and Research NSERC PGS Committee (Member), ORS Review Committee (Member), UofR Employee Ambassador, URFA Advisory Committee (Member for Contract Negotiations), Faculty of Graduate Studies Graduate & Undergraduate Scholarship Committee (Member), External Examiner of M.Sc. Defense (Engineeringx2, Mathematicsx1), Chair of Ph.D. Defense (Educationx1), UofR-UofS Science Committee on Teaching Efficiencies (Member)

External Service (Last 10 Years)

Academic Service

Ph.D. Thesis External Examiner (UofAx1, UofMx1), Ph.D. Committee Member (Physicsx2), M.Sc. Supervisory Committee Member (Physicsx2), Reviewed 5 faculty members (1 in Canada, 4 in Greece) for promotion and advancement

Discipline/Collaboration Service

Collaboration Board Chair (2010-2011), Board Member (2008-2009), Calorimetry Working Group Co-Coordinator (2007-present), BCAL Construction Project Liaison (2009 - September 2012), BCAL Beam Test Run Coordinator (2006), WNPPC Organizing Committee Member (2006), CAP & APS Conference & GlueX Meeting Session Organizer/Convener (25 sessions), IEEE Reviewer, Jefferson Lab Proposal Reviewer, Contributor to NSERC and Compute Canada LRP, Science Panelist University of Thessaloniki, Greece (2007)

Professional Service

CAP P.Phys. Designation, Division of Nuclear Physics, Canada [Chair (2013 - 2015), Chair Elect (2011-2013), Past Chair (2015-2017),] Member of CAP & Divisions DNP, DMBP, DPE, DIMP, DIAP (Canada), APS (USA), Canadian Institute of Nuclear Physics Board Member (2008-2010), CINP & DNP Webmaster, Southeastern Universities Research Association-SURA [Initiatives Funds Committee Chair (2015),

Programs Steering Committee Member (2012-2015), University of Regina Appointee to SURA Board of Trustees (2010-present)], Nominating Committee for Jefferson Lab Board of Directors (2008)

Outreach/Community Service

Presentation to High School Career Days (2015), Presentation to High School Councilors (2014-2015), High School and Elementary Scholl Lab Tours (multi year), Fielding Questions from the Public, Science Fair Judge (2010, 2015), Media Appearances [TV (8), Radio (3), Newspaper (9), Press Releases/Press Conferences (7)]

Significant Research Contributions (Last 6 Years)

1. A. Baulin et al., (author: Z. Papandreou), Attenuation length and spectral response of Kuraray SCSF-78MJ scintillating fibres, Nuclear Instruments and Methods in Physics Research A 715 (2013) 48-55.
Over 750,000 1-mm-diameter 4-m-long Kuraray scintillating fibres were used in the BCAL. An extensive study of the response of ~5,000 randomly chosen fibres was carried out. The measurements agreed qualitatively (spectral response) and quantitatively (attenuation length) with measurements conducted by Kuraray on fibres from the same batches. The results set reference standards in fibre performance.

2. T.D. Beattie et al., (author: Z. Papandreou), Light yield of Kuraray SCSF-78MJ scintillating fibers for the GlueX Barrel Calorimeter, Nuclear Instruments and Methods in Physics Research A 767 (2014) 245-251.
The quality of a random sample (4,750) of the Kuraray fibres was evaluated by exciting them at their mid point using a ^{90}Sr source. These measurements afforded the determination of the number of photoelectrons with statistical confidence, useful to the community at large.

3. E.G. Anassontzis et al., (authors: Z. Papandreou and C. Kourkoumelis), Relative Gain Monitoring of the GlueX Calorimeters, Nuclear Instruments and Methods in Physics Research A 738 (2014) 41-49.
This was a joint R&D effort between our group and the U of Athens on the development of a relative gain monitoring system for the GlueX calorimeters, based on small LEDs, with the goal to monitor the gain stability of the MPPCs.

4. T.D. Beattie et al., (author: Z. Papandreou), Methodology for the Determination of the Photon Detection Efficiency of Large-Area Multi Pixel Photon Counters, IEEE Transactions on Nuclear Science, Vol. 62, No. 4, (2015) 1865-1872.
The 3,840 BCAL large-area MPPC arrays are based on a 3x3mm^2 cell populated by 50μm pixels, with 16 such cells tiled in a 4x4 arrangement. The MPPCs are read out via a 16-summed output and this results in amorphous ADC spectra were individual photopeaks are not resolvable. To extract the PDE, we developed a mathematical model based on the Poisson statistical behaviour of the summed signal. Vendors provide arrays and their electronics in an integrated package including an amplitude summing circuit, so our method can be conveniently applied to the analysis of data from such devices.

Contributions 1 and 2 were part of the BCAL construction, a massive effort for our group and the largest such project in the history of Physics at the U of Regina. JLab/DOE designated the BCAL detector as "long-lead" due to the stringent requirements behind the production of the required 3,000 kilometers of

fibres. As a result, funding was made available to us about a year before any other project in the JLab 12 GeV Upgrade. Department of Energy's (DOE) Office of Science followed our performance closely. We completed the construction 6 months ahead of schedule, which was considered a major success in the entire Upgrade Project, as we delivered the very first detector for the Upgrade across all experimental halls. DOE and JLab officials came to Regina to offer official congratulations during a press conference organized by our university. Provincial and Federal Government representatives were present, as was the local press, radio and TV. We were interviewed on live radio and drove respective public relations and outreach. CTV and CBC filmed both applicants and ran news segments.

In 2006 3x3mm^2 SiPM units were just becoming available. We needed devices 1.3cm^2 in size, and succeeded in carrying out R&D and in guiding a small photonics company in Ireland, SensL, to develop those, funded by US$500,000 from the DOE. Now, large-area SiPMs/MPPCs, based on the BCAL standard, are commercially available for applications from subatomic physics to PET imaging.

List of Recent Publications (Last 6 Years)

I have authored the majority of 22 GlueX technical reports by our group, and delivered 9 invited talks and 55 contributed presentations in this period. The full peer-reviewed article list can be found at http://inspirehep.net/search?ln=en&p=find+a+papandreou%2C+z+and+date+%3E+2004&of=hb&action_search=Search&sf=earliestdate&so=d

Publications

104) T.D. Beattie et al., IEEE Transactions on Nuclear Science, Vol. 62, No. 4, (2015) 1865-1872.
103) T.D. Beattie et al., NIM A 767 (2014) 245-251.
102) E.G. Anassontzis et al., NIM A 738 (2014) 41-49.
101) A.E. Baulin et al., NIM A 715 (2013) 48-55.
98) H. Fonvieille et al., Phys. Rev. C 86, 015210 (2012)
97) S. Prakhov et al., PRC 82 015201 (2010) 1-10.
96) D. Mekterovic et al., Physical Review {\bf C 80} 055207 (2009) 1-12.
95) S. Prakhov et al., Physical Review {\bf C 80}, 025204 (2009).
94) T.D.S. Stanislaus et al., Physical Review {\bf C 79} 015203 (2009) 1-8.
93) G. Laveissiere et al., Physical Review {\bf C 79} 015201 (2009) 1-18.

Proposals – approved

100) GlueX Collaboration, Proposal to JLab PAC42, arXiv:1305.1523 [hep-ex] (August 2014).
100) GlueX Collaboration, Proposal to JLab PAC40, arXiv:1305.1523 [hep-ex] (May 2013).
99) GlueX Collaboration, Proposal to JLab PAC39, arXiv:1210.4508 [hep-ex] (October 2012)

Technical Reports

61) T. Beattie et al., GlueX Technical Report, GlueX-doc-2821, October 2015.
60) A. Foda et al., GlueX Technical Report, GlueX-doc-2817, October 2015.
59) Z. Papandreou, GlueX Technical Report, GlueX-doc-2694, May 2015.

58) Z. Papandreou, GlueX Technical Report, GlueX-doc-2379, December 2013.
57) Z. Papandreou, Chapter of the GlueX Technical Design Report, August 2013.
56) Z. Papandreou, GlueX Technical Report, GlueX-doc-2245, June 2013.
55) L.A. Teigrob and Z. Papandreou, GlueX-doc-664-v4, May 2013.
54) D. Kolybaba et al., GlueX-doc-2121, December 2012.
53) Y. Cao et al., GlueX-doc-1956, April 2012.
52) G.J. Lolos et al., GlueX-doc-1900, March 2012.
51) S. Katsaganis and Z. Papandreou, GlueX-doc-1889, January 2012.
50) S. Katsaganis and Z. Papandreou, GlueX-doc-1871, December 2011.
49) Z. Papandreou et al., GlueX-doc-1864, November 2011.
48) Z. Papandreou et al., GlueX-doc-1816, September 2011.
47) Z. Papandreou et al., GlueX-doc-1720, March 2011.
46) Z. Papandreou et al., GlueX-doc-1649, December 2010.
45) Z. Papandreou et al., GlueX-doc-1647, December 2010.
45) Z. Papandreou et al., GlueX-doc-1573, August 2010.
44) Z. Papandreou, GlueX-doc-1536, May 2010.

External Research Funding (Last 6 Years)

Investigator(s)	Grant Title/Subject	Total Amount	Years of Tenure
Papandreou, Z. & 1 other	NSERC Discovery Grant	$405,000	2015-2018
Babyn, P. (UofS) & 17 others (ZP was the UofR PI)	Sylvia Fedoruk Program Grant	$5,166,444 (total) $1,450,00 to UofR	2015-2019
Papandreou, Z. & 2 others	NSERC Engage Grant	$25,000	2014
Papandreou, Z. & 3 others	Canadian Centre for Nuclear Innovation Grant	$118,430	2013-2015
Lolos, G.J and Papandreou, Z.	NSERC Project Grant	$432,000	2012-2015
Papandreou, Z. and Lolos, G.J.	JLab/DOE Grant	$1,468,400	2009-2012
Papandreou, Z. and Lolos, G.J.	JLab/DOE Grant	$52,500	2009
Lolos, G.J and 2 others	NSERC Project Grant	$620,000	2009-2012

Shaun Szymanski

Lab Instructor II

szymanss@uregina.ca, (306) 585 4243,

Education and Professional Development

Master's of Science, Theoretical Physics 2010

University of Regina, Regina, SK

Thesis title: *The Strange Quark Mass In Lattice QCD*

Thesis Supervisor: Dr. R. Lewis

Bachelor of Science, Physics and Mathematics 2003

University of the Fraser Valley, Abbotsford, BC

Employment History

Tenure Granted 2011

Lab Instructor II (Physics) 2011 - present

Lab Instructor I (Physics) 2006 - 2011

Teaching History

Physics labs taught for the following classes:

Physics 109 – General Physics I

Physics 119 – General Physics II

Physics 111 – Mechanics

Physics 112 – Waves and Optics

Physics 201 – Electricity and Magnetism

Physics 242 – Introduction to Modern Physics

Physics 261 – Heat and Thermodynamics

Physics 292 – Physics of Continuous Media

Student Supervision

Supervision of 16-20 graduate and undergraduate teaching assistants per year. Teaching assistants generally teach labs for Physics 109 and Physics 119.

University Service

- Member of the Science Lab Instructor Review Committee 2010 – 2012 (Chair in 2012)
- Member of joint Physics/Engineering Liaison Committee
- Physics Lab Instructor Hiring Committee 2010
- Chemistry Lab Instructor Hiring Committee 2011
- Physics Lab Instructor Hiring Committee 2013
- Hiring Committee for Science Operations Coordinator 2014
- Chemistry Lab Instructor Hiring Committee 2015
- Chemistry Lab Instructor Hiring Committee 2015
- Annual participation in the Regina Science Fair
- Annual participation in Science Rendezvous
- Demonstrations for Science Summer Camps
- Demonstrations for high school classes
- Demonstrations for elementary school classes
- Demonstrations for Girl Guides of Canada

Teaching Development and Outreach

- Maintenance, repairs and upgrades to existing laboratory teaching equipment
  -Continuous use of equipment by undergraduate students results in a frequent need to repair damaged or broken equipment and upgrades are performed when possible
- New experiments designed at the first and second year levels
  -Boyle's Law: a previous version of this experiment used a glass u-tube filed with mercury, which was deemed to be hazardous in the case of breakage and spillage. A new Version of this experiment was designed using pneumatic air cylinders. Data could be collected over a large range of pressures and volumes and provided very consistent results

-Two-slit Experiment: this experiment is at the second year level and is designed to be a bridge experiment to third year. Students use a very sophisticated apparatus (compared to a similar experiment in first year) and are provided with a detailed user manual. They are required to explore the possibilities of the apparatus and write a sophisticated report as if it would be a lab manual for another student.

-Speed of Light: this experiment was designed in conjunction with a second year student that had an interest in the topic. The speed of light is measured in a very brute force method of distance over time. Precise set up and measurements provide very reasonable results. A SiPM provided by one of the research groups provides the light detection.

- Lab Manuals

  -A complete rewrite of all student manuals has been performed in recent years. The labs have switched from a 3 hour plus take home assignment, to a strictly 3 hour in-lab assignment. This required careful editing of the manuals to ensure the time limits could observed.

- Online Lab Assignments

  -Since the students meet only every second week in the lab, online assignments for the off-weeks have been developed. The online assignments are delivered through URCourses and provide students with extra practice of some of the core concepts and calculations. Large question banks have been developed and the software randomly chooses which questions each student sees. This provides different assignments for every student.

- Lab Demonstrations

  -Jet Bike: this is a pedal bike that has been outfitted with a pulse-jet engine that provides 50 lbs. of thrust. This demonstration is used for outside events and produces crowd-pleasing fire and noise.

  -Scuba Tank Skateboard: this is a skateboard outfitted with a 3000psi scuba tank that provides the thrust via ball-valve operated by the rider. This is used for inside demonstrations.

  -Ruben's Flame Tube: this is a long copper tube with evenly spaced holes drilled along the top of its entire length. Propane is plumbed into this tube and an audio speaker is placed at one end. The standing waves inside the tube are visually seen in the flames dancing above the tube from the expelled propane. Individual notes as well as music can provide great visuals.

  -Kelvin's Thunderstorm: this demonstration uses a combination of dripping water and metal buckets to segregate charges from a reservoir of water. Static charge builds up in

the metal buckets until it jumps a spark gap. Sparks of 30,000-40,000 Volts can be observed.

- Outreach Activities

  -High School Demonstrations: some school divisions require certain classes to be exposed to material outside their own classroom. Groups of grade 11 and 12 students come to the physics department for 1 hour demonstrations. Topics have included waves and high speed phenomenon.

  -Science Rendezvous: the physics labs provide demonstrations for this public event hosted by the faculty of science. We have provided many demonstrations, open labs and a stage show in the past.

  -Girl Guides: the physics labs partnered with the chemistry labs put on a late-night demonstration for a local Girl Guides group who were participating in an all-night event. The demonstrations were designed to be visually pleasing in the dark.

Aram Teymurazyan
Assistant Professor of Physics
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Education and Professional Development

Degree	Area of Study	Institution	Date
Ph.D.	Physics	U of Kentucky	2008
M.Sc.	Physics	U of Kentucky	2005
B.Sc.	Physics (Honours)	Yerevan State U	2000

Employment History

Employer	Position Title	Period
U of Regina	Assistant Professor	7/2015-Present
Lakehead U	Post-Doctoral Fellow	6/2013-6/2015
U of Toronto	Post-Doctoral Fellow	1/2010-5/2013
U of Massachusetts	Post-Doctoral Research Associate	1/2008-2/2010

Student and Post-Doctoral Supervision

Name	Position	Dates of Supervision	Current Employment
Postdoctoral & Relevant Trainees			
Jamie, Stoker	Research Assistant	9/2015 – present	U of R
Graduate Students			
Harutyun, Poladyan	Ph.D. student (co-supervisor)	5/2014 – present	Lakehead University
Undergraduate Students			
Yasmim, Rocha	Undergraduate Researcher	8/2015 – 12/2015	
Carolina, Cechinel	Undergraduate Researcher	8/2015 – 6/2016	
James, Day	Physics (Honours) Project Adviser	9/2015 – 5/2016	

University Service (Last 10 Years)

Academic Service

Master's Thesis defense Chair, Master's Candidate Stephanie Christine Kary, Supervisor Dr. Andrew Cameron, U of R Department of Biology.

PhD Thesis Committee member, PhD Candidate Anezka Kolaceke, Supervisor Dr. Mauricio Barbi, U of R Department of Physics.

External Service (Last 10 Years)

Professional Service

Reviewer for *Medical Physics* – the scientific journal of the American Association of Physicists in Medicine, the official science journal of the Canadian Organization of Medical Physics, the Canadian College of Physicists in Medicine, and the International Organization for Medical Physics.

Elsevier Reviewer for *Physica Medica* – the European Journal of Medical Physics, the scientific journal of Associazione Italiana di Fisica Medica and the European Federation of Organisations for Medical Physics. An international forum for research and reviews on Medical Imaging, Radiation Therapy, Radiation Protection, Measuring Systems and Signal Processing, Education and training in Medical Physics.

As well as, for *Applied Radiation and Isotopes* – a journal of nuclear and radiation techniques and their applications in the physical, chemical, biological, medical, earth, planetary, environmental, security and engineering science.

Reviewer for *IEEE Transactions on Biomedical Engineering*

Significant Research Contributions (Last 6 Years)

1. From 2010 to 2013 I have been developing Geant4 based Monte Carlo simulations to explore advanced detector concepts for x-ray imaging, with general goals of minimizing undesirable dose delivery to the patient while maximizing image quality. In particular, novel high quantum efficiency megavoltage x-ray imaging detectors can greatly improve the external beam radiotherapy treatments by increasing the positional accuracy of the treated target. The conventional electronic portal imaging devices (EPIDs), used to locate the high-energy radiotherapy beam during treatment, are only 2-to-4% efficient at utilizing the incident x-ray fluence. The designs proposed by co-authors and I can be up to 60% efficient. Such a high efficiency opens the possibility of generating a megavoltage portal image with one single Linac pulse, which would enable the treatment setup verification at the instance of Linac pulse delivery. Publication **15** below describes a quantum noise limited EPID that together with designs presented in Publications **11** and **13** make up a new class of EPIDs with reduced sensitivity, in comparison to conventional EPIDs, to scatter radiation originating in the imaged subject. Overall, my work on x-ray imaging detectors resulted in five peer-reviewed publications [Publications **15-11** in below] and five conference presentations.

2. Recently, a research group in Sydney, Australia has attempted a prototype using basic ideas described in the publication **12** (please see Samuel J. Blake, Aimee L. McNamara, Shrikant Deshpande, Lois Holloway, Peter B. Greer, Zdenka Kuncic, and Philip Vial. (2013). Characterization of a novel EPID designed for simultaneous imaging and dose verification in radiotherapy, Medical Physics. 40: 091902). Although their prototype did not achieve predicted image quality due to sub-optimal design, it demonstrated excellent dosimetric properties as predicted in Publication 5. Presently, I, with co-authors of Publication 5, am pursuing improved prototypes of EPIDs that will achieve both high efficiency and high image quality.

3. From 2013 to 2015 I have been working on the development of PET block detectors with a SiPM readout. My work, on development of cost efficient SiPM based PET block detectors that possess high spatial resolution, high sensitivity, and MRI compatible compact design has resulted in a disclosure to the Thunder Bay Regional Research Institute and MaRS Innovation. Based on the disclosure, the decision has been reached with MaRS Innovation to set up a start-up company and commercialize the design of the PET block detector. A patent application is in preparation.

List of Recent Publications (Last 6 Years)

Publications

16. Teymurazyan et al., “High precision photon flux determination for photon tagging experiments,” Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **767**, 300-309 (2014).
15. A. Teymurazyan, J. A. Rowlands and G. Pang, “Monte Carlo simulation of a quantum noise limited Čerenkov detector based on air-spaced light guiding taper for megavoltage x-ray imaging," Medical Physics **41**, 041907 (2014).
14. M. F. Fast, A. Teymurazyan, G. Pang, U. Oelfke and J. A. Rowlands, “Finding an improved amorphous-silicon x-ray at-panel detector configuration for the in-line geometry,” Physics in Medicine and Biology **58**, 2305-2324 (2013).
13. A. Teymurazyan and G. Pang, “An inherent anti-scatter detector for megavoltage x-ray imaging,” Physics in Medicine and Biology **58**, 1479-1493 (2013).
12. A. Teymurazyan and G. Pang, “Monte Carlo simulation of a novel water-equivalent electronic portal imaging device using plastic scintillating fibres,” Medical Physics **39**, 1518-1529 (2012). also re-published in Virtual Journal of Biological Physics Research/ Volume **23** / Issue 5 / INSTRUMENTATION DEVELOPMENT
11. A. Teymurazyan and G. Pang, “Megavoltage X-Ray Imaging Based on Cerenkov Effect: A New Application of Optical Fibres to Radiation Therapy,” International Journal of Optics, **vol. 2012**, Article ID 724024, 13 pages, 2012.
10. I. Larin et al., “A New Measurement of the π^0 radiative decay width,” Physical Review Letters **106**, 162303 (2011).
9. B. A. Perdue et al., “Cross sections for the three-body photodisintegration of ^{3}He at E_γ =12.8, 13.5, and 14.7 MeV,” Physical Review C **83**, 034003 (2011).
8. M. Battaglieri et al., “Photoproduction of $\pi^+\pi^-$ meson pairs on the proton,” Physical Review D **80**, 072005 (2009).
7. P. Martel et al., “Nuclear Targets for a Precision Measurement of the Neutral Pion Radiative Width,” Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers,

Detectors and Associated Equipment **612**, 46-49 (2009).
6. M. Battaglieri et al., “Measurement of direct f0(980) photoproduction on the proton," Physical Review Letters **102**, 102001 (2009).

Technical Reports

20. P. -N. Seo et al. (2010). Study of the 11B(p, α) Reaction Below Ep = 3.8 MeV, TUNL Progress Report XLIX. 2. Duke University
19. B. A. Perdue et al. (2010). Measurements of the Absolute Cross Section of the Three-Body Photodisintegration of 3 He Between E_γ = 11.4 MeV and 14.7 MeV at HIγS, TUNL Progress Report XLIX. 2. Duke University
18. N. J. Brown et al. (2010). BrilLanCe Detector Energy Resolution Characterization at HIγS, TUNL Progress Report XLIX. 2. Duke University
17. P. -N. Seo et al. (2010). The Study of the 11B(α, p) Reaction with an α- Particle Energy from 4.0 MeV and 7.0 MeV, TUNL Progress Report XLIX. 2. Duke University
16. S. S. Henshaw et al. (2010). Compton@HIγS on 209Bi from E_γ = 15-30 MeV, TUNL Progress Report XLIX. 2. Duke University
15. N. J. Brown et al. (2010). 11 B(α, α) Elastic Cross-Section Measurements, TUNL Progress Report XLIX. 2. Duke University
14. P. P. Martel et al. (2010). Scintillating Target for d(γ,γ)d at HIγS, TUNL Progress Report XLIX. 2. Duke University
13. B. A. Perdue et al. (2009). Absolute Measurements of the Differential Cross Section of the 3He(γ, n)pp Reaction Below E_γ = 14.7 MeV at HIγS, TUNL Progress Report XLVIII. 2. Duke University
12. P. P. Martel et al. (2009). HIγS NaI Detector Array (HINDA) Commissioning, TUNL Progress Report XLVIII. 2. Duke University
11. A. Teymurazyan et al. (2009). coda2root; C@T File Parsing Utility, TUNL Progress Report XLVIII. 2. Duke University
10. N. J. Brown et al. (2009). BrilLanCe Detector Energy Resolution Characterization at HIγS, TUNL Progress Report XLVIII. 2. Duke University
9. P. -N. Seo et al. (2009). Study of 11B(p, α) reaction below 400keV, TUNL Progress Report XLVIII. 2. Duke University
8. A. Teymurazyan et al. (2009). GEANT4 Simulation Package for HINDA and HIFroST, TUNL Progress Report XLVIII. 2. Duke University
7. S. Stave et al. (2009). Linearly Polarized Beam Induced Photo-Neutron Yield Ratios in the GDR Region at HIγS, TUNL Progress Report XLVIII. 2. Duke University
6. P. P. Martel et al. (2009). Scintillating Target for d(γ, γ)d at HIγS, TUNL Progress Report XLVIII. 2. Duke University
5. S. S. Henshaw et al. (2009). Compton@HIγS on 209Bi from E_γ = 11-30 MeV, Report XLVIII, TUNL Progress. 2. Duke University

External Research Funding (Last 6 Years)

Investigator(s)	Grant Title/Subject	Amount	Years of Tenure
Aram Teymurazyan	Capital Startup – Sylvia Fedoruk Centre for Nuclear Innovation Research Chair in Nuclear Imaging Technologies	$200,000 (total)	7/2015-7/2020
Aram Teymurazyan	Capital Startup – U of Regina Research Chair in Nuclear Imaging Technologies	$30,000 (per year)	7/2015-7/2020

Wayne Tokaruk

Laboratory Instructor I

Wayne.Tokaruk@uregina.ca, (306) 585 4205,

Education and Professional Development

1995: **M.Sc., Physics,** University of Regina

Thesis: *Energy Functions and Hamiltonians in Neural Network Theory*

1988: **B.Sc., Physics (Honours),** University of Regina

Seminar: *On Learning and Memory in Neural Networks*

Employment History

2013-2015: **Laboratory Instructor,** Department of Physics, University of Regina

2013: **Sessional Lecturer,** Department of Physics, University of Regina

2012: **Sessional Lecturer,** Department of Physics, University of Regina

2011: **Sessional Lecturer,** Department of Physics, University of Regina

2009: **Laboratory Instructor,** Department of Physics, University of Regina

2007-2010: **Teaching Assistant,** Department of Physics, University of Regina

2007-2008: **Research Assistant,** Department of Physics, University of Regina

Teaching History

2013-2015: **PHYS 109**, **PHYS 112**, **PHYS 119**, and **PHYS 201, Laboratory**

Responsible for teaching a number of sections of first and second year undergraduate labs. Duties included preparation of laboratory material, teaching in the lab, individual

instruction of students outside of scheduled labs, marking weekly lab books, supervision of teaching assistants, supervision and marking of the final lab exam, and compilation of final lab grades.

2013: **PHYS 119 - General Physics II, Lecture**

Responsible for teaching one section of this course in the winter semester. Duties included preparing and presenting lectures, individual instruction of students during regular office hours, maintaining the course website, preparation of weekly assignments and supervision of teaching assistants, liaison with laboratory instructors and teaching assistants for the lab portion of the course, preparation and marking of the midterm and final exam, and final compilation of grades.

2012: **PHYS 119 - General Physics II, Lecture**

Responsible for teaching two sections of this course in the winter semester. Duties included preparing and presenting lectures, individual instruction of students during regular office hours, maintaining the course website, preparation of weekly assignments and supervision of teaching assistants, liaison with laboratory instructors and teaching assistants for the lab portion of the course, preparation and marking of the midterm and final exam, and final compilation of grades.

2011: **PHYS 119 - General Physics II, Lecture**

Responsible for teaching two sections of this course in the winter semester, and a further section in the fall. Duties included preparing and presenting lectures, individual instruction of students during regular office hours, maintaining the course website, preparation of weekly assignments and supervision of teaching assistants, liaison with laboratory instructors and teaching assistants for the lab portion of the course, preparation and marking of the midterm and final exam, and final compilation of grades.

2009: **PHYS 109**, **PHYS 111**, **PHYS 119**, and **PHYS 201, Laboratory**

Responsible for teaching a number of sections of first and second year undergraduate labs. Duties included preparation of laboratory material, teaching in the lab, individual instruction of students outside of scheduled labs, marking weekly lab books, supervision of teaching assistants, supervision and marking of the final lab exam, and compilation of final lab grades.

2007-2010: **PHYS 109**, **PHYS 119**, and **PHYS 201, Laboratory**

Repeated appointments to teach first and second year undergraduate labs. Duties included teaching in the lab, individual instruction of students during regular office hours, marking weekly lab books, marking of the final lab exam, and compilation of final lab grades. I also marked assignments and exams for **PHYS 109**, **PHYS 119**, and **PHYS 142**.

Student Supervision

Name	Position	Dates of supervision

University Service

2015

- Participated in the Regina Regional Science Fair, judging and discussing projects with the students.
- Participated in Science Rendezvous, particularly safety/crowd control during our live demonstrations of the Physics Jet Bike.

2014

- Participated in the Regina Regional Science Fair, judging and discussing projects with the students.
- Participated in Science Rendezvous, particularly safety/crowd control during our live demonstrations of the Physics Jet Bike.
- Provided demonstration apparatus, and instruction in its use, to Dr. Edward Doolittle of First Nations University for use in a high school outreach project.
- Participated in an outreach promotional tour of the Physics and Chemistry departments for students from Southey high school. The demonstrations were well received by the students, including that of standing wave patterns on Chladni plates.

2013

- Participated in Science Rendezvous, particularly safety/crowd control during our live demonstrations of the Physics Jet Bike and Physics Scuba Tank Skateboard.
- Participated in Luther College's "Jumpstart". New Luther students had to locate the physics labs as part of a campus scavenger hunt. In the lab, we had prepared a demonstration using the Van de Graff Generator.

Teaching Development

- An ongoing major effort is underway to prepare new tutorials and assignments in the first and second year labs. This is a highly collaborative effort between Mr. Shaun Szymanski and I. We are using URCourses to deliver the new material along with existing documents transferred from our traditional website. We have moved all first and second year labs to URCourses and retired our previous website. All laboratory material is now available on URCourses only (printed copies are no longer available through the bookstore). New documents and activities have been added to the PHYS 109 and PHYS 119 pages. These include new online assignments: "Calculating Uncertainties" (109), "Finding a Linear Relationship using a Graph" (109), "Using Measuring Instruments" (109), "Finding the Uncertainty in an Average" (109), "PHYS 109 Review" (119), "Power Relationships and Log-Log Graphing" (119), "Exponential Relationships and Semi-Log Graphing" (119), and "Circuit Calculations" (119).
- Monitored student performance in the new online assignments in PHYS 109 and PHYS 119. Initial statistics and feedback from teaching assistants indicate that the assignments are having a positive effect.
- Redesigned and tested the PHYS 201 experiment "The Dipole Field" to use a student version of a modern Hall probe to measure the magnetic field strength. Modified the existing write-up in the lab manual to use the new apparatus and procedure.
- Tested calibration and measurement of the earth's magnetic field as part of the PHYS 201 experiment "The Dipole Field". This experiment uses a student version of a modern Hall probe to measure magnetic field strength. Students successfully calibrated their Hall probes against a known field produced by a pair of Helmholtz coils. The calibrated probe was then used to measure the field of the dipole, and the horizontal and vertical components of the earth's field.
- Investigated use of the Arduino microcontroller board as an inexpensive platform for automated data acquisition and control of lab demonstrations, and for potential use in second year laboratories such as PHYS 201.
- Incorporated the use of new power supplies into existing experiments in PHYS 201, along with corresponding operating instructions for student use.
- Supervised 16-20 graduate and undergraduate teaching assistants per year.