

Physics Seminar Abstracts 2009 - 2010

Brachytherapy Calibrations: The first step towards clinical use

Prof Larry DeWerd

Department of Medical Physics

University of Wisconsin

Location: Rm 5115 Herzberg Physics

Date: 2009-09-09

Time: 15:30-16:30

Abstract:

Brachytherapy sources have increased in use for the treatment of cancer. The two most prevalent applications are prostate cancer with low-energy, low-dose-rate sources and balloon treatment of the tissue remaining in the breast after excision of the tumor. The latter treatment uses high dose rate sources. All of these applications start with the proper calibration and measurement of the sources. The research program at the University of Wisconsin has developed calibrations and measurements of each of the sources involved for these treatments. The calibration and methodology involved for these sources, spanning the energy range and the dose rate range, will be discussed.

Contact: Dave Rogers

Non-invasive optical imaging in biomedicine

Sangeeta Murugkar

School of Information Technology and Engineering, University of Ottawa

Location: Herzberg 4351

Date: 2009-09-15

Time: 15:15-16:15

Abstract:

Biophotonics is a rapidly emerging field arising from the convergence of photonics and life sciences. It involves applications for imaging, diagnostics and therapeutics related to human health. Light interacts with living systems at a molecular level, enabling ultra-high spatial resolution combined with ultra-high sensitivity. This talk will focus on the development and applications of non-invasive optical imaging techniques in biomedicine. Nonlinear optical interaction with cellular constituents permits imaging with inherent 3-dimensional sectioning capability, deeper penetration in tissue along with fast data acquisition times. Our implementation of a nonlinear optical microscopy technique based on coherent anti-Stokes Raman scattering (CARS) using a novel fiber optics based light source, will be discussed. Applications of CARS microscopy in such diverse areas as neuroscience and detection of waterborne pathogens, will be demonstrated, followed by a brief description of recent work involving development of a multimodal nonlinear optical endoscope.

Contact: Dave Rogers

Physics Seminar Abstracts 2009 - 2010

Brachytherapy physics with BrachyDose

Rowan Thomson

Location: Herzberg 4351

Date: 2009-09-29

Time: 15:15-16:15

Abstract:

Brachytherapy is a type of radiation treatment for cancer in which radioactive sources are placed next to or inside a tumour. Fast and accurate calculations of dose, the energy deposited in tissue by radiation, remain a challenge for these treatments. In cancer centres, dose calculations are performed using a formalism which has the advantage of speed at the expense of accuracy. Significant physical effects are ignored and calculated doses differ substantially from those delivered to patients. Over the last few years, a fast Monte Carlo dose calculation algorithm for brachytherapy applications, BrachyDose, has been developed by a group in the Carleton Laboratory for Radiotherapy Physics. This talk will focus on recent BrachyDose-related research. Results from studies of dosimetry for brachytherapy treatments of ocular melanomas will be presented. Features of BrachyDose, current research, and future plans will be discussed.

Contact: Dave Rogers

"Two-minute seminars"

Physics Department Faculty and RAs

Carleton University

Location: Herzberg 4351

Date: 2009-10-06

Time: 15:00-16:00

Abstract:

Every year we hold a special seminar to introduce ourselves to any new people in the department. Each faculty member and RA gets two minutes to describe who they are and what they do. RAs/postdocs and grad students are especially invited.

Contact: Heather Logan and David Asner

=== OCIP Seminar ===

Nano-mechanics of materials: physics or engineering?

Ron Miller

Department of Mechanical and Aerospace Engineering

Carleton University

Location: Herzberg 4351

Date: 2009-10-20

Time: 15:00-16:00

Abstract:

Miniaturization, MEMS and NEMS technology and the processing of materials to endow them with nano-scale microstructural features has challenged the way we model and predict material behaviour. As the size of structural elements approaches the atomic scale, new phenomena emerge and others are suppressed, leading to unexpected properties. These can be beneficial, as in the case of enhanced strength of nano-structured alloys, or detrimental, as in the case of surface effects in NEMS resonators. In this talk, we present a broad overview of some interesting problems in materials science at the nano-scale and discuss techniques aimed at more accurately modeling, understanding and predicting material behaviour. The focus will be on the models that combine traditionally "physics" techniques (density functional theory, molecular dynamics) with traditionally "engineering" techniques (finite elements, fracture mechanics) to tackle problems that neither approach can adequately address alone.

Contact: Tong Xu

Physics Seminar Abstracts 2009 - 2010

Clinical proton dosimetry: a brief overview and challenges

Gabriel Sawakuchi

M.D. Anderson Cancer Center, Houston, Texas

Location: Herzberg 4351

Date: 2009-10-27

Time: 15:15-16:15

Abstract:

Proton radiation therapy is becoming increasingly popular because it promises dose conformality comparable to or better than those in IMRT treatments, while significantly sparing the normal surrounding tissue because of the low entrance dose and virtually no exit dose when compared to conventional treatment methods using photon or electron radiation. This presentation provides a brief overview of proton radiation therapy. The emphasis is on the physics of clinical proton dosimetry. First, a summary of the number of facilities and patients treated worldwide using proton radiation therapy will be presented. Next, the relevant physics of proton interaction with matter is discussed. Then, a brief summary of the beam delivery technologies will be given. From the physics standpoint, some important unresolved issues in the field of clinical proton dosimetry include: 1) estimating range uncertainties; 2) modeling dose distributions; and 3) measuring linear energy transfer which relates to the relative biological effectiveness of the proton dose. Research focused on advancing the knowledge in the mentioned issues through Monte Carlo simulations and measurements of proton radiation therapy beams will be presented. An overview of the current results and future research will be discussed.

Contact: Dave Rogers

Kaon Spectroscopy with B-Mesons

Hulya Guler

McGill University

Location: Herzberg 4351

Date: 2009-11-03

Time: 15:00-16:00

Abstract:

I will show an analysis of the $K^+ \pi^+ \pi^-$ final state in the decays $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$ and $B^+ \rightarrow \psi'(K^+ \pi^+ \pi^-)$ based on 535M B-meson pairs collected by the Belle detector at the KEKB e^+e^- collider. To determine the resonant substructure of this final state, an amplitude analysis is performed in the three dimensions $M^2(K^+ \pi^+ \pi^-)$, $M^2(K^+ \pi^-)$, and $M^2(\pi^+ \pi^-)$. The $K_1(1270)$ is found to be the dominant contribution in both J/ψ and ψ' decay modes. Interference among the different intermediate states is significant and is particularly spectacular between the $K^+ \rho$ and $K^+ \omega$ decay modes of the $K_1(1270)$. An additional fit in which the mass and width of the $K_1(1270)$ are floated provides an improved measurement of these quantities.

Contact: David Asner

Physics Seminar Abstracts 2009 - 2010

=== OCIP Seminar ===

Nuclear Medicine and the Isotope Shortage

Richard Wassenaar

The Ottawa Hospital

Location: Herzberg 4351

Date: 2009-11-10

Time: 15:00-16:00

Abstract:

With the shutdown of Chalk River earlier this year, a world-wide shortage of Tc-99 was seen. Despite all of the press surrounding this issue, there is still a lot of confusion among the general public regarding this shortage and Nuclear Medicine in general. In this talk, I'll review the basis for nuclear medicine imaging, the physics behind the cameras, and the types of tests performed. This will lead into the type of isotopes used, and why Tc-99m is used in over 90% of all Nuclear Medicine tests. Current, reactor-based methods of producing Mo-99, the precursor to Tc-99m, will be explained and novel methods for producing Tc-99m to prevent future shortages will be reviewed.

Contact: Tong Xu

Studies of $D \rightarrow \pi e \nu$ and $D \rightarrow K e \nu$ at CLEO-c

Laura Fields

Cornell

Location: Herzberg 4351

Date: 2009-12-01

Time: 15:00-16:00

Abstract:

Many precision tests of the Standard Model require input from Lattice QCD (LQCD) or other QCD techniques. Of particular importance are the semileptonic form factors used to extract V_{ub} in semileptonic B decays. Similarities between the D and B sector make charm semileptonic decays an excellent testing ground for the increasingly precise predictions of LQCD. CLEO-c has recently used its entire data sample to produce a set of measurements involving the decays $D^0 \rightarrow \pi e \nu$, $D^0 \rightarrow K e \nu$, $D^+ \rightarrow \pi^0 e \nu$ and $D^+ \rightarrow K^0 e \nu$. These results, which include the world's most precise branching fraction and D \rightarrow π form factor measurements, will be discussed.

Contact: David Asner

Physics Seminar Abstracts 2009 - 2010

The Flavour of Things to Come: Prospects for the SuperB Experiment

Steve Robertson

McGill University

Location: Herzberg 4351

Date: 2009-12-08

Time: 15:00-16:00

Abstract:

The current generation of B factory experiments have been overwhelmingly successful in their characterization of non flavour-diagonal and CP violating couplings of heavy quarks, as recognized in 2008 by the Nobel committee in its award to Kobayashi and Maskawa. However, many of these same flavour physics observables are expected to be very sensitive to "new physics" contributions from heavy particles, either at or even well beyond the mass scales accessible at the LHC at CERN, thus motivating a new generation of extremely-high luminosity heavy flavour experiments. The SuperB experiment, which would be hosted by the Frascati (LNF) laboratory, would aim to collect two orders of magnitude more data than existing B factory experiments. The new accelerator would exploit several novel design features, enabling electron-positron collisions at unprecedented luminosities while maintaining a clean, low-background experimental environment. This facility would operate concurrently with the LHC and would provide complementary sensitivity to physics beyond the Standard Model. In this talk I will present the physics motivation for high luminosity flavour studies, describe the accelerator and detector concepts, and discuss the status of ongoing efforts towards a full technical design for SuperB.

Contact: David Asner

OCIP - graduate student symposium

location: Carleton University, C164 Loeb Building

Date: 2009-12-15

Time: 13:30-17:10

Abstract:

1:30 pm - Jason Boulet (U. Ottawa), "Stochastic two delay-differential model of delayed visual feedback effects on postural dynamics"

1:50 pm - Rick Ueno (Carleton U.), "Study of Eelectron signals from leptonic W decay process in ATLAS detector."

2:10 pm Daniel Charlebois (U. Ottawa), "Stochastic simulation of gene expression and heterogeneous population dynamics"

2:30 pm - Adam Robichaud (Carleton U.), "Diamond pixel sensor development for an ATLAS detector upgrade in an sLHC environment"

2:50 pm - Harold Kwok (U. Ottawa), "Crack interaction at the atomic scale"

3:10 pm *Break with refreshments*

3:30 pm David Roy-Guay (U. Ottawa), "Quantum dot lasers for telecommunications",

3:50 pm - Suad Abuzariba (U. Ottawa), "Theoretical calculation of system performance of fiber optic networks",

4:10 pm - Clair Footitt (Carleton U.), "Perfusion measurements in brain and prostate cancer: Use of MRI signal phase to measure the arterial input",

4:30 pm - Serge Leblanc (U. Ottawa), "Non invasive retinal oximetry: the key to ocular health?",

4:50pm - Jeremy Lefebvre (U. Ottawa), "Dynamics of a recurrent neural field network with external driving"

Contact: Gerald Oakham

Physics Seminar Abstracts 2009 - 2010

OCIP 2009 Christmas Symposium

Location: University of Ottawa, Complexes Biosciences, Room 140

Date: 2009-12-18

Time: 09:30-13:00

Abstract:

9:30 am - Manuelle Vincter, "Probing the infinitesimal to the infinite with the Large Hadron Collider"

10:00 am - Javier Giorgi, "Oxides and nanostructures: from surface science to fuel cells"

10:30 am - Thomas Gregoire, "Looking for alternative models of electroweak symmetry breaking"

11:00 am - *break with refreshments*

11:30 am - Stavros Tavoularis, "Fluid mechanic research"

12:00 pm - Paul Johns, "X-Ray coherent scatter imaging: Using diffraction from people"

12:30 pm - Christophe Py, "A patch-clamp array neurochip for disease models and pharmacological development"

Contact: Gerald Oakham

Revealing Randall-Sundrum Hidden Valleys

Jay Hubisz

Syracuse University

Location : Herzberg 4351

Date: 2010-03-16

Time: 15:00-16:00

Abstract:

I will discuss extra-dimensional hidden sectors which are hidden from the standard model through either small gauge coupling, or vanishing quantum numbers. RS gravity provides a bridge between the standard model and such hidden sectors, allowing for TeV scale probes of super-weakly-coupled new physics. In particular, Peccei-Quinn axion model is described with novel low-scale interactions.

Contact: Thomas Gregoire

Physics Seminar Abstracts 2009 - 2010

THE EINSTEIN-PODOLSKY-ROSEN PARADOX AND THE NATURE OF REALITY

Shohini Ghose

Wilfrid Laurier University

Location: Southam 413

Date: 2010-03-18

Time: 14:30-15:30

Abstract:

In 1935 Einstein, Podolsky and Rosen wrote a seminal paper in which they discussed a thought experiment that led them to question the completeness of the theory of quantum mechanics. The paradox arose from the fact that in quantum mechanics, measurements of one member of a correlated (entangled) pair of objects seem to instantaneously affect the other member, no matter how far away - an effect Einstein called 'spooky action at a distance'. The EPR paradox led to much scientific and philosophical debate regarding the interpretation of quantum mechanics, causality and the nature of reality. In 1964, Bell devised a practical test for the existence of objective elements of reality that are compatible with the predictions of quantum mechanics. This talk will describe the EPR paradox, the idea of quantum entanglement and experimental tests of Bell's inequalities. I will also discuss the new interest in entanglement as a resource for quantum computing and communication, and our recent surprising results on entanglement and Bell's inequalities in multipartite quantum systems.

BIOGRAPHICAL NOTES

Shohini Ghose joined Wilfrid Laurier University in 2005 as an Assistant Professor in the Department of Physics and Computer Science. Prior to that, she held an Alberta Ingenuity Fellowship at the Institute for Quantum Information Science, University of Calgary. Her research interests lie in the areas of quantum computing, quantum information theory, nonlinear dynamics and quantum optics. She and her co-workers have recently performed the first experiments demonstrating signatures of chaos in entanglement dynamics.

-OMPI seminar -

New Effective Dose Estimates for Rubidium-82 Based on Dynamic PET/CT Imaging in humans.

Chad Hunter

Carleton University & Heart Institute

Location : Herzberg 5115

Date: 2010-03-25

Time: 15:15-16:00

Abstract:

Abstract: Objectives: Published radiation dose estimates for Rubidium-82 vary widely, and no comprehensive study in man has yet been conducted. With the increasing use of Rb-82 PET for myocardial perfusion imaging, improved dosimetry information is needed for accurate risk assessment. The purpose of this study was to measure Rb-82 internal organ and effective doses with PET/CT in humans. Methods: We recruited 26 cardiac patients and 4 normal subjects with no cardiac history. Dynamic 3D PET scans were acquired (GE Discovery RX/VCT) over 10 minutes following IV injection of 10 MBq/kg Rb-82. Images were reconstructed using FORE-OSEM and 8 mm Hann filter. Cardiac scans of the chest were acquired at rest for all 30 subjects, plus one additional scan of the Head, Neck, Abdomen, Pelvis, or Thighs. Mean Rb-82 residence times were determined in 22 source organs using volumes-of-interest (VOI) drawn on the fused PET/CT images. For large organs a small VOI was used to avoid partial volume losses. For small organs the average activity above 80% threshold was multiplied by the volume at 40% of the peak value within the organ VOI. Target organ doses and the effective dose estimate were calculated using OLINDA/EXM 1.0 according to ICRP 60, and recalculated according to ICRP 103. Results: A total of 283 organs were measured across the 60 scans, with at least 4 samples obtained in each source organ. The average 'adult' effective dose for Rubidium-82 was found to be 0.00074 mSv/MBq using ICRP 60. Using ICRP 103, the male and female effective doses were 0.00074 and 0.00092 mSv/MBq respectively. The highest dose organs were the lungs, kidneys and stomach wall. Conclusion: These dose estimates for Rubidium-82 are the first to be measured directly with PET/CT in humans, and are 4 to 4.5 times lower than previous ICRP 60 values based on a theoretical blood flow model. The new values derived from human studies suggest a typical effective dose of 0.6 mSv per scan with 3D PET. Research Support: DRAXimage, Ontario Research Fund.

Refreshment at 3:15pm

Contact: Tong Xu

Physics Seminar Abstracts 2009 - 2010

-OMPI seminar-

Long Range Detection of Radioactive Threat Material

Laurel Sinclair

Nature Resources Canada

Location: Herzberg 5115

Date: 2010-03-25

Time: 16:00-17:00

Abstract:

Abstract: In both security investigations and incident remediation work, there is a need to precisely define the locations of man-made radioactivity in the environment. Deploying simple gamma and neutron detectors from an airborne platform has proven a valuable method to delineate dispersed radioactivity. However, in some scenarios, a land-based detection system is required. The presence of partial shielding in these cases, and the restriction of the survey platform to roads, necessitates the use of instruments capable of directionality or imaging. To address this need, we are working with a commercial partner on a synthetic aperture gamma array detector. We are also designing and building a rugged and transportable Compton gamma imager. The latest results from these development efforts will be presented.

Contact: Tong Xu

-Public Lecture-

Global Isotope Crisis

Richard Wassenaar, Ph.D.

Medical Physicist, Nuclear Medicine The Ottawa Hospital

and

Paul Schaffer, Ph.D.

Deputy Head, Nuclear Medicine TRIUMF

Location: Azrieli Theatre - room 302

Date: 2010-03-31

Time: 19:00-20:30

Abstract:

Nuclear medicine has been a mainstay of the Canadian healthcare system for over 50 years and continues to rely heavily on a critical medical isotope: technetium-99m. Technetium-99m, a radioisotope with ideal properties for diagnostic imaging, is used in over 85% of nuclear imaging procedures, totaling over 20 million diagnostic scans worldwide every year. Canadian nuclear reactors, until recently, have played a pivotal role in the world's production of the isotopes required for nuclear medicine. Due to our reactor's age, however, unexpected shutdowns are becoming more frequent, and these have affected the supply and availability of technetium-99m. Canadian innovation is leading the way in developing alternative means of isotope production. This public lecture will focus on the importance of medical isotopes in your healthcare, the reasons for the current isotope crisis and the answers Canadian scientists are seeking to move nuclear medicine forward. The presentation will introduce the science behind isotope production, radiotracer synthesis and image acquisition, and discuss the alternative technologies being developed for isotope production.

Contact: Tong Xu

Physics Seminar Abstracts 2009 - 2010

Alternative Technologies for the Production of Medical Isotopes.

Paul Schaffer

Deputy Head, Nuclear Medicine TRIUMF

Herzberg 4351

Date: 2010-04-01

Time: 13:30-14:30

Abstract:

Abstract: The speaker will give a introduction of the efforts at TRUMF regarding medical isotope production, followed by a round-table discussion of future possibilities .

Contact: Tong Xu

Searching for hidden sectors with high intensity experiments

Brian Batell

Perimeter Institute

Location : Herzberg 4351

Date: 2010-04-06

Time: 15:00-16:00

Abstract:

Abstract: I will discuss the theoretical and experimental motivation for a hidden sector - a new set of elementary particles which do not carry electromagnetic, weak, or strong charges - and how we can probe such states at high intensity collider and fixed target experiments.

Contact: Thomas Gregoire

Results for muon decay parameters from TWIST

Glen Marshall

Triumf

Location : Herzberg 4351

Date: 2010-04-13

Time: 15:00-16:00

Abstract:

Muon decay offers an opportunity to test the Standard Model of particle physics in a purely leptonic situation where more ambiguous strong interaction processes are essentially absent. The TRIUMF Weak Interaction Symmetry Test (TWIST) was designed specifically to improve by an order of magnitude the precision of the decay parameters ρ , η , and P_μ derived from measured energy and angle distributions of positrons from polarized positive muon decay. It tests the V-A structure of the decay by comparing the parameters to those predicted by the Standard Model in an analysis permitting more general Lorentz-invariant local terms. Since the completion of data taking in 2007, a careful analysis has been carried out with the aim of improving upon earlier intermediate results, by reducing systematic uncertainties, estimating residual biases, and evaluating consistency checks. The total uncertainties, representing improvements of 9, 12, and 7 in ρ , η , and P_μ , respectively, as compared to pre-TWIST experiments, are dominated by systematic uncertainties. The analysis was blind with respect to the central values of the parameters, and the hidden parameters were revealed in late January 2010. The talk will describe muon decay and the way in which we measure it. The experimental apparatus and analysis procedures will be presented, with particular attention to the reduction of leading systematic uncertainties. The results of the blind analysis and their uncertainties will be shown along with implications and limitations for physics beyond the Standard Model.

contact: David Asner

Physics Seminar Abstracts 2009 - 2010

Carleton University Physics Department Summer Students symposium

Herzberg 5115

Date: 2010-08-17

Time: 13:30-15:30

Abstract:

1:30 pm.: Andrew Scullion[Sawakuchi] "Monte Carlo Simulation for Proton Beam Therapy using Geant 4"

1:50 pm. : Marc-André Roy[Logan], "Higgs Couplings and Gluon Fusion Rates"

2:10 pm: Tom Brown [Grégoire], "Dark Matter Abundance in a Little Higgs Model with T-parity"

2:30 pm: Miriam Diamond[Gilberg], "Positioning of the Forward Calorimeters in ATLAS"

2:50 pm: Charles-Antoine Collins-Fekete[Oakham], "Diamond detector research at Carleton"