The muon: "Who ordered that?"

Trevor J. Stocki

Research Scientist/Adjunct Professor
Radiation Protection Bureau/Carleton University

Date: Tuesday, September 13, 2011

Time: 3:30PM- 4:30PM

Location: HP 4351

Abstract:

In the early days of particle physics, the muon was viewed by some as an extra unnecessary particle. In the modern era, this is far from true. The muon has many applications from a probe of solid state physics to issues of security. This talk will introduce the muon's interesting history.

Then results from some modern day muon capture experiments will be presented. Specifically, the muonic hyperfine transition rates were measured in LiF, $(CF_2)_n$, Na, NaH, Al, $LiAlH_4$, and for the first time in K and P. These compounds were investigated for chemical environmental effects on the transition rates. As well, nitrogen was examined. If the only way a hyperfine transition can occur is through Auger emission and because the hyperfine splitting energy is smaller than the energy needed for the Auger process, then nitrogen should not have a muonic hyperfine transition. Confirmation of a previous nonzero measurement of a hyperfine effect in nitrogen was attempted. This attempt led to much new information, such as the yields of gamma rays produced from muon capture in nitrogen. Previously only the yield from one gamma ray had been measured. The results of all of these measurements will be discussed.

All of this muon capture work has led to the involvement into some interesting "proof of concept" security experiments. Preliminary results from these experiments involving muonic atoms will be presented.

Direct Measurement of the Quantum Wavefunction

Charles Bamber

Research Scientist
NRC

Date: Tuesday, September 20, 2011

Time: 3:30PM-4:30PM

Location: HP 4351

Abstract:

Central to quantum theory, the wavefunction is a complex distribution associated with a quantum system. Despite its fundamental role, it is typically introduced as an abstract element of the theory with no explicit definition. Rather, physicists come to a working understanding of it through its use to calculate measurement outcome probabilities through the Born Rule. Tomographic methods can reconstruct the wavefunction from measured probabilities. In contrast, we present a method to directly measure the wavefunction so that its real and imaginary components appear on our measurement apparatus. We will describe an experimental example by directly measuring the transverse spatial wavefunction of a single photon. This method gives the wavefunction a plain and general meaning in terms of a specific set of operations in the lab

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Muon Manna from the Heavens: Cosmic Rays and National Security

David Waller

Research Scientist
Defence Research and Development Canada

Date: Tuesday, September 27, 2011

Time: 3:30PM- 4:30PM

Location: HP 4351

Abstract:

The Earth is constantly bombarded by energetic, galactic cosmic rays. Muons are often produced when the cosmic rays collide with gas molecules in the upper atmosphere. At sea level the flux of muons is approximately 10,000/m^2/min. Two research projects are currently being carried out by Defence Research and Development Canada (the R&D agency for National Defence), Carleton University, and other collaborators to investigate the feasibility of using these naturally occurring muons to enhance national security.

The first project is called **Cosmic Ray Inspection and Passive Tomography (CRIPT)**. A large prototype muon scattering tomography system is under construction at Carleton; it will examine the effectiveness of muon scattering tomography for contraband special nuclear material detection and nuclear non-proliferation applications. After an introduction to the technical challenges posed by these applications, a review of CRIPT's progress will be presented. This progress includes the construction and testing of two small muon detector prototypes: drift chambers at Carleton and scintillator detectors at Advanced Applied Physics Solutions (a not-for-profit company associated with TRIUMF).

The second project, **FOREWARN (Forebush Observations in Realtime of Extreme space Weather: Assisting Readiness through Notification)** is a collaborative effort with Natural Resources Canada's Space Weather Forecast Centre to investigate the feasibility of using changes in the cosmic-ray-muon flux to provide early warning of extreme space weather (ESW). ESW can occur around the Earth when a coronal mass ejection (CME) from the Sun is directed at our planet. When these billion tonne balls of plasma strike the Earth at up to 10,000,000 km/hr, there can be severe impacts on our critical infrastructure: the electricity grid and satellites are two of the most important vulnerabilities. The trajectories of cosmic rays are affected by CMEs so a sudden change in the flux and angular distribution of muons on the Earth's surface might provide up to a day's warning that the arrival of a CME is imminent. Construction of a small muon telescope, using CRIPT drift chambers, has recently begun at Carleton. It will be taking muon data while the Sun's activity increases towards the maximum of the current solar cycle (expected in 2013).

Dark Matter Search with CDMS and SuperCDMS

Wolfgang Rau

CRC/Assistant Professor
Queens University

Date: Tuesday, October 11, 2011

Time: 3:30pm-4:30pm

Location: HP4351

Abstract:
With first hints for its existence as long as 80 years ago and a large number of more recent and very compelling observations, the nature of Dark Matter has become one of the great mysteries of modern day science at the interphase of particle physics on one and astrophysics and cosmology on the other side.

The Cryogenic Dark Matter Search experiment (CDMS) and its successor SuperCDMS try to confirm the hypothesis that dark matter consists of Weakly Interacting Massive Particles which would interact in the cryogenic
semiconductor detectors operated by these experiments.

This talk will start with an introduction into the field of dark matter and its detection. The main focus will be on the CDMS technology, the results of CDMS and the status and plans for SuperCDMS, which is expected to move to SNOLAB, the new deep underground laboratory near Sudbury, ON, after its present phase at the much shallower Soudan Underground Laboratory in Minnesota is concluded.

Joint Physics Colloquium & OCIP Seminar: Why we care about the Higgs boson

Dr. Heather Logan
Professor of Physics
Carleton University
Date: Tuesday, October 25, 2011
Time: 3:30pm-4:30pm
Location: HP 4351
Abstract:

Even after decades of glorious experiments in particle physics, we still don't know why particles have mass. Our best guess is the Higgs mechanism -- the single part of the Standard Model yet to be experimentally tested. I'll explain the problem of mass and the Higgs solution, and describe how experiments currently underway at the Large Hadron Collider at CERN will help us answer one of the biggest questions in particle physics.

Interfacing Physics and Biology by System-based Computational Modeling in Radiation Oncology: Prospects and Challenges

Issam El Naqa
Associate Professor
McGill University
Date: Tuesday, November 8, 2011
Time: 3:30PM-4:30PM
Location: HP 4351
Abstract:

Patients who undergo radiotherapy are at risk of experiencing tumor recurrence or complications to normal tissues after treatment. Due to the inherent complexity and heterogeneity of radiation interaction with biological processes in tumors and normal tissues, traditional radiobiological methods have fallen short of providing sufficient predictive power when applied prospectively to personalize treatment regimens. Therefore, we are investigating system-based computational approaches that integrate physical and biological information to adapt intra-radiotherapy changes and optimize post-radiotherapy treatment outcomes. The development of such “radio-biophysiomics” system is based on extracting relevant anatomical and physiological image features, identification of robust molecular biomarkers of radiation response and sophisticated computer modeling methods to quantify patient’s treatment risk. If successful, this would allow patients and the treating team to select treatment regimens or modalities that are most appropriate to the patient’s biophysical profile and anticipated response.

Joint Physics Colloquium & OCIP Seminar: "Physics challenges in proton therapy"

Harald Paganetti

Associate Professor/Director of Physics Research
Harvard Medical School/Massachusetts General Hospital, Department of Radiation Oncology

Date: Tuesday, November 22, 2011

Time: 2:00PM- 3:00PM

Location: HP 4351

Abstract:
The interest in proton therapy is steadily increasing with more and more centers opening worldwide, particularly in the United States. While proton therapy treatments are on their way to becoming routine in radiation oncology there are still many challenges and open questions. After a short introduction into proton therapy and its benefits compared to standard photon therapy this presentation will outline some of the uncertainties in precisely delivering proton therapy treatments and how physics research is trying to address those. Focus will be on Monte Carlo simulations, in vivo treatment verification imaging, and treatment planning strategies to minimize uncertainties.

Time Series Analysis of Dark Matter Direct Detection Experiments

Itay Yavin

Assistant Professor/Associate Faculty Member
McMaster University/Perimeter Institute for Theoretical Physics

Date: Tuesday, November 29, 2011

Time: 3:30pm-4:30pm

Location: HP 4351

Abstract:

Over the past several years several experiments announced the observation of temporal modulations in the nuclear recoil rates in experiments looking for dark matter in the laboratory. I will begin by discussing the different experiments and the various claims. In particular I will discuss the results of the DAMA and CoGeNT experiments. The bulk of the talk will be devoted to a careful analysis of the observed modulation and a comparison with other known temporally modulated phenomena. At least a portion of the talk will involve an introduction to the various statistical tools used in the analysis, which might be of interest to astronomers as well.

Ottawa Carleton Institute for Physics Graduate Student Symposium: Fall 2011

Date: Thursday, December 8, 2011

Time: 2:00 PM - 4:50 PM

Location: Loeb Building, room C-164, Carleton University

Abstract:

2:00 Dave Houtman (M.Sc., U. Ottawa)
A neural model of call counting in anuran amphibians

2:20 Justin Sutherland (Ph.D., Carleton U.)
Model-based dose calculations for I-125 lung brachytherapy implants

2:40 Alison Harman (M.Sc., U. Ottawa)
Flow and rupture of vesicles in narrow channels

3:00 Jason Belec (Ph.D., Carleton U.)
Monte Carlo simulations of dynamic external beam photon treatments

3:20 Break with refreshments / Pause avec rafrachissements

3:50 Xiaozhen Wang (Ph.D., U. Ottawa)
Narrow-linewidth tunable fibre lasers based on micro-fibre devices

4:10 Jared Strydhorst (Ph.D., Carleton U.)
Quantitative small-animal micro-SPECT with attenuation correction and scatter compensation

4:30 Christopher Smeenk (Ph.D., U. Ottawa)
Imaging atomic and molecular orbitals via laser tunnelling

OCIP 2011 Christmas Symposium

Date: Tuesday, December 13, 2011

Time: 9:30 am - 1:00 pm

Location: MacDonald Hall (MCD) room 121, University of Ottawa

Abstract:

9:30 Rob de Kemp, "Rubidium-82 alternative to Technetium-99m for cardiac blood flow imaging"

10:00 Vincent Tabard-Cossa, "Nanopores: Electronic tools for single-molecule biophysics"

10:30 Thomas Koffas, "Higgs searches via its decay to 4 leptons or 2 photons with the ATLAS detector"

11:00 Break with refreshments/ Pause et rafrachissements

11:30 Ben Sussman, "Controlling the Quantum: From photons to solids"

12:00 Malcolm Butler, "New techniques and perspectives in nuclear physics"

12:30 Liam Kieser, "RF quadrupole reaction cells for eliminating atomic isobars in accelerator mass spectrometry"

13:00 Lunch: Jazzy Restaurant, University Centre (UCU), first level

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Developing MRI Technology to Study Changes in the Architecture of the In Vivo Human Cerebral Cortex

Dr. Jennifer McNab

CIHR Research Fellow
Athinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School

Date: Thursday, January 5, 2012

Time: 1:30pm-3:00pm

Location: HP 4351

Abstract:

My scientific interests are centered on developing MRI technology that will interrogate the architecture of the in vivo human cerebral cortex at an unprecedented level of detail. With this technology I aim to provide non-invasive MRI signatures of cortical (re)organization that will transform our understanding of brain function development, aging, plasticity, neuronal disease etiology and progression. My approach to probing cortical architecture is through the development of advanced diffusion-weighted (DW) MRI technology. DW-MRI is sensitive to tissue microstructure including: membranes, myelin, macromolecules and packing geometry. Due to the folded geometry of the cortex, measurements within and between cortical layers require an acquisition with an isotropic voxel grid and an analysis that is oriented with the local reference frame derived from the geometry of the cortical ribbon. In this talk I will discuss several technological developments aimed at bring in vivo human DW-MRI to the laminar and columnar level in the cerebral cortex including: laminar analysis techniques, the construction of close-fitting radio-frequency array coils and strong magnetic gradient coils as well as the design of unique MRI pulse-sequence encoding schemes and protocols. I will present in vivo human results of a surface-based analysis of diffusion orientation in the primary somatosensory and motor cortices and some recent acquisitions of the first ever in vivo human axon diameter measurements.

Detector Development for Compact and Multimodality Positron Emission Tomography (PET) Imaging Systems

Dr. Andrew Goertzen

Assistant Professor
Department of Radiology, University of Manitoba

Date: Monday, January 9, 2012

Time: 1:15pm-2:30pm

Location: HP 4351

Abstract:

Positron emission tomography (PET) imaging is an important nuclear medicine method used both for assessment of diseases such as cancer and Alzheimer's Disease in clinical patients and for research into understanding disease processes and developing new therapies. Using PET imaging to study small animal models of human disease allows for non-invasive assessment of disease progression and response to therapy, reducing the effects of variability in the course of a disease across a population of research animals. Due to the small size of the animals being imaged, PET systems designed for small animal imaging require spatial resolution that is significantly better than that required for imaging human subjects, making the design and construction of these PET systems a significant physics and engineering challenge. We are developing compact PET systems for mouse imaging with two system design goals in mind. In the first, we propose to build a small footprint PET system based on dual-ended readout of 2 x 2 x 100 mm3 axially oriented scintillator crystals readout at either end by low-cost position sensitive photomultiplier tubes (PS-PMTs). This system is designed to operate on a laboratory benchtop or within a containment area such as a biosafety cabinet, where there is not space for current generation animal PET systems. The second system we propose to build is an MRI compatible PET system designed to fit within the bore of a 7T animal MRI system, allowing simultaneous PET and MR imaging of the mouse. This system design uses dual-layer scintillator arrays readout by silicon photomultiplier (SiPM) photodetectors. These SiPM detectors have performance comparable to conventional photomultiplier tubes (PMTs) while being a fraction of the size and immune to magnetic fields seen in MRI imaging. The combination of PET and MRI for these animal studies will enable significant new research into animal models of disease, particularly with neurological and cardiac applications.

Instrumentation to improve the spatial resolution and sensitivity in small animal PET

Dr. Sara St. James

Harvard Medical Physics Residency Program
Harvard Medical School

Date: Tuesday, January 17, 2012

Time: 3:30pm-4:30pm

Location: HP 4351

Abstract:

The motivation for using positron emission tomography (PET) is twofold. PET is a very sensitive imaging technique with reported sensitivity of 10^{-11} - 10^{-12} moles/liter. Positron emitting radionuclides are atoms that may be attached to biologically relevant molecules, making the chemistry of PET flexible. For clinical and pre-clinical molecular imaging, PET is capable of imaging the underlying biological processes.

There remain several challenges specific to small animal PET that need to be addressed. The spatial resolution in commercial small animal PET scanners is ~ 1 mm, leading to partial volume effects and problems in quantification for structures smaller than 2 mm. In addition, the duration of an imaging study using a small animal PET scanner is on the order of 10-30 minutes. This duration is, in part, due to the sensitivity of the scanner. With an increase in sensitivity, the duration of the scan may be reduced without sacrificing image quality. Additional benefits to increasing the sensitivity of the scanner include the improvement of dynamic studies of the tracer distribution in the subject and the potential to reduce the injected amount of radionuclide (decreasing the radiation dose to the subject).

Detector design to improve the spatial resolution and sensitivity of small animal PET is explored in this talk. To improve the spatial resolution, detectors with smaller elements were developed, progressing from detectors with individual crystal sizes of 0.7 mm X 0.7 mm X 20 mm to detectors with individual crystal sizes of 0.22 mm X 0.22 mm X 20 mm. These detector designs are complemented by Monte Carlo simulations that explore the sensitivity and spatial resolution achieved with such detectors. Novel tapered detector designs are explored as is a single-detector insert to locally improve the spatial resolution and sensitivity of an existing small animal PET scanner.

Accelerator Production of the Medical Isotope Tc-99m

William T. Diamond

Emeritus
Atomic Energy of Canada Limited (CRNL)

Date: Tuesday, January 31, 2012

Time: 3:30-4:30pm

Location: HP4351

Abstract:

This talk will provide a broad overview of the present and future methods for producing ^{99}Mo which is used in about 80% of the estimated 80,000 nuclear medicine procedures performed daily in North America. The main part of the talk will focus on the production of ^{99}Mo or ^{99m}Tc with high-power accelerators. ^{99}Mo can be produced with an electron linac using the ^{100}Mo(Î^{3},n)^{99}Mo reaction on a separated isotope ^{100}Mo target. ^{99m}Tc can be produced by using the ^{100}Mo(p,2n)^{99m}Tc reaction and isotope-production cyclotrons with proton energies from about 16 to 25 MeV. A number of the technical challenges and the status of both approaches will be reviewed.

The Canadian Hydrogen Intensity Mapping Experiment (CHIME) - a new tool to probe the dark energy driven expansion history of the universe from z=1-3

Matt Dobbs

Canada Research Chair in Astro-particle Physics
Department of Physics, McGill University

Date: Tuesday, February 7, 2012

Time: 3:30PM-4:30PM

Location: HP 4351

Abstract:
The most surprising discovery in cosmology since Edwin Hubble observed the expansion of the Universe is that the rate of this expansion is accelerating. This either signals that a mysterious Dark Energy dominates the energy density of the Universe, or that our understanding of gravity on large scales is incorrect. The Canadian Hydrogen Intensity Mapping Experiment (CHIME) will produce the largest volume astronomical survey to date, potentially unlocking the mysteries the dark-energy driven expansion history of the Universe. The CHIME telescope forms an image of the entire over-head sky each night by digitally processing the information received on a compact array of 2500 radio receivers. Unlike traditional telescopes that mechanically point and observe a small region of the sky, CHIME is able to observe the entire overhead sky without any moving parts by decoding the information received by the stationary radio receiver array. We are currently building a pathfinder version of CHIME. I'll describe the CHIME concept and its science potential.

The Astrophysics of Cold Dark Matter

Kristine Spekkens

Assistant Professor
Department of Physics, Royal Military College of Canada

Date: Tuesday, February 14, 2012

Time: 3:30PM- 4:30PM

Location: HP 4351

Abstract:

There is now overwhelming astrophysical evidence that 85% of the matter density of the Universe is made up of cold dark matter. In this talk, I will review the astrophysical need for invoke dark matter, as well as the observations that constrain its properties. I will then discuss the apparent discord between predicted and observed dark matter halos in galaxies, and provide an update on progress towards reconciling these discrepancies within the cold dark matter paradigm. Finally, I will describe promising avenues for future astronomical observations that, together with particle physics experiments, may elucidate the nature of the dark matter.

The Matter with Antimatter

Dr. David Morrissey

Research Scientist
TRIUMF

Date: Tuesday, February 28, 2012

Time: 3:30pm-4:30pm

Location: HP4351

Abstract:

One of the biggest puzzles in elementary physics is why the Universe seems to contain so much more matter than antimatter. Our current understanding of elementary particles treats matter and antimatter in nearly the same way, and is unable to explain the observed asymmetry. In this talk I will explain the source of the puzzle in more detail, and I will describe some of the ways in which it might be solved. I will also comment on how these proposed explanations might lead to new and unusual signals in current and upcoming particle collider experiments and astrophysical observations.

Special Department Seminar: The SPES Project: a Neutron Rich ISOL Facility for re-accelerated RIBs

Dr. Leandro Piazza

Research Scientist
INFN-Legnaro, Italy

Date: Monday, March 5, 2012

Time: 10:15am-11:30am

Location: HP 4351

Abstract:

SPES (Selective Production of Exotic Species) is an INFN project to develop a Radioactive Ion Beam (RIB) facility as an intermediate step toward EURISOL.
The SPES Project is under realization at the INFN Legnaro National Laboratories site.
The SPES Project main goal is to provide an accelerator system to perform forefront research in nuclear physics by studying nuclei far from stability. The SPES Project is concentrating on the production of neutron-rich radioactive nuclei with mass in the range 80-160.
The final energy of the radioactive beams on target will range from few MeV/u up to 11 MeV/u for A=130. The SPES acceleration system will be presented, together with the facility realization status and scientific program.

Taking a "nu" Look: Studying Low-Energy Solar and Terrestrial Neutrinos with Borexino

Dr. Alex Wright
Physics Department, Princeton University

Date: Friday, March 16, 2012
Time: 3:30pm-4:30pm
Location: HP4351

Abstract:

Solar neutrino experiments have taught us a great deal about neutrinos, neutrino oscillations, and the nuclear fusion reactions that power the sun. The Borexino experiment has made important new solar neutrino measurements by extending neutrino spectroscopy to very low energies. In this talk I will review what we have learned (and are still learning!) about solar neutrinos and the Sun. I will also describe our measurement of the flux of terrestrially produced "geo-neutrinos" and how this and similar measurements can allow us to study the chemical composition of the Earth's interior, and to better understand our planet's thermal history.

Searching for Oscillating Neutrinos at T2K: Results and Prospects

Dr. Mark Hartz
T2K Experiment, Toronto and York Universities

Date: Thursday, March 22, 2012
Time: 3:30pm-4:30pm

Location: HP4351

Abstract:

Neutrino oscillations have been a hot topic in recent decades as experiments have revealed large mixing between nature's most enigmatic elementary particles. In contrast to the mixing of quarks, measurements have shown that two of the neutrino mixing angles are near maximal.
Until recently, however, oscillations through the smallest mixing angle, ?_13 , had not been observed. T2K is a long baseline high intensity neutrino oscillation experiment employing an off-axis beam to search for the appearance of electron neutrinos in a muon neutrino beam, oscillations that are governed by ?_13. In 2011, T2K released a search for electron neutrino appearance that rejected a value of zero for ?_13 at 90% confidence, opening the door for the observation of CP violation in neutrino oscillations. In this talk, I will review the measurements of electron neutrino appearance and muon neutrino disappearance made by T2K. I will also discuss the future prospects for T2K in light of the many recent exciting results in neutrino oscillation experiments.

The Magnetism in Massive Stars (MiMeS) Project

Gregg Wade

Professor
Department of Physics, Royal Military College of Canada

Date: Tuesday, March 27, 2012

Time: 3:30PM- 4:30PM

Location: HP 4351

Abstract:

The Magnetism in Massive Stars (MiMeS) project aims to explore the origin, characteristics and physical impact of magnetic fields in hot, massive stars. Supported by 3 large observing programs corresponding to a commitment of over 1500 hours of telescope time, the MiMeS collaboration is comprised of an international team of over 50 observers, modellers and theoreticians located in 15 countries. This talk will review the motivation and structure of the project, then describe a few recent results selected from: first statistical results from the MiMeS survey and the inferred basic characteristics of massive star magnetism; confrontation of theoretical predictions of the influence of magnetic fields on internal circulation and mixing of OB stars; direct observation and modeling of stellar wind channeling and confinement in both B and O type stars; and ongoing efforts to test hypotheses that weak, heretofore undetected magnetic fields are at the root of cyclical variability inferred to occur in the winds of most, if not all, OB stars.

A paradigm shift in physics until 2025 because of the LHC?

Dr. David Cote

Physics Department Research Fellow
CERN, PH-ADP

Date: Thursday, March 29, 2012

Time: 2:45pm-3:45pm

Location: HP4351

Abstract:

The Large Hadron Collider (LHC) has performed beautifully in 2010-2011. Its flagship experiments, ATLAS and CMS, have produced hundreds of results that expand our knowledge of particle physics and often received large amounts of media coverage. I will begin with a summary of the current status of this research, with particular emphasis on the search for the Higgs boson where an excess is observed. However, the present successes are probably just the tip of the iceberg: the LHC will produce 600 times more data by 2025 and its energy will be doubled from 2015. The heart of the presentation will be devoted to my personal research plan for this very exciting period. The main themes will be the potential discovery of dark matter produced in laboratory and the construction of new sub-detectors for the ATLAS upgrades.

Special CAP Lecture: "Efficiency in the Cell: How Cells Make Proteins Rapidly While Working to a Budget"

Dr. Paul Higgs

Professor
Physics Department, McMaster University

Date: Tuesday, April 3, 2012

Time: 3:30pm-4:30pm

Location: HP 4351

Abstract:

A biophysicist might view a cell as a factory that makes macromolecules. Like all factories, a cell requires energy to work, and energy comes at a cost. Cells that make efficient use of their resources grow and divide faster. Processes that are costly to the cell will be under natural selection, and should evolve towards increased efficiency. One of the most important processes in the cell is

translation, the process by which proteins are synthesized by ribosomes. A ribosome is a molecular machine that decodes the genetic information from an mRNA sequence and constructs a protein. Ribosomes bind to one end of a mRNA and move forward, adding one amino acid to the protein for each codon (three nucleotides). One way for cells to be efficient is to make proteins that are cheap; hence, cells tend to make more frequent use of amino acids that are cheaper to synthesize. Another way to be efficient is to speed up the translation process, so that proteins can be made faster with a limited number of ribosomes. The time taken by the ribosome per codon depends on the codon used. Sequence analysis of many bacterial genomes shows that faster codons are indeed preferred. There is also a cost to a cell of making the wrong protein sequence. Thus, selection can act on the accuracy of translation as well as the speed. If more than one ribosome is bound to a single mRNA, these follow one another like trains along the same track. Regions of slow codons can lead to ribosomal traffic jams. We will discuss the application of particle hopping models from statistical physics to the problem of ribosome dynamics and traffic jams. This talk will be an example of how those with a background in physics can build quantitative models that help in understanding important questions in biology and molecular evolution.

Centers and Centroids of the Projection of a Sphere

Dr. Rolf Clackdoyle

Directeur de Recherche
Laboratoire Hubert Curien, Universite Jean Monnet

Date: Tuesday, April 17, 2012

Time: 3:30pm-4:30pm

Location: HP4351

Abstract:

Consider the elliptical shadow on a screen of a small solid sphere illuminated by an ideal point light source. The question is to find the point inside the ellipse corresponding to the (projection of the) center of the sphere, when the position of the light source is unknown. The center of the ellipse is not the right answer. This problem arises in geometric calibration of tomographic scanners where the objective is to establish the mapping between points in space and their projected detector locations by imaging small dense ball bearings (BBs). In this case, an ideal X-ray source is assumed so the BB is not opaque and the elliptical shadow exhibits intensity variations. A popular approach is to use the centroid of these intensities to estimate the projected center of the BB. It has recently been established that the centroid is not the right answer either. A method is presented for

quantifying the errors incurred when the ellipse center estimate or the centroid estimate is used, with an example from Dr. Tong Xu's X-ray laboratory.

Ottawa Carleton Institute for Physics Graduate Student Symposium: Spring 2012 - PART 1

Date: Wednesday, May 2, 2012
Time: 1:30 PM – 5:00 PM
Location: MacDonald Hall, room MCD 121

Abstract:

SYMPOSIUM DES ÉTUDIANTS DES CYCLES SUPÉRIEURS

OCIP GRADUATE STUDENT SYMPOSIUM

PRINTEMPS 2012, PARTIE 1 - SPRING 2012, PART 1

Mercredi, le 2 mai 2012, 13h30 -17h00

Wednesday, May 2, 2012, 1:30 PM – 5:00 PM

MacDonald Hall, pièce MCD 121 - Université d'Ottawa

MacDonald Hall, room MCD 121 - University of Ottawa

1:30 Ben Spencer (M.Sc., Carleton U.), "Volumetric x-ray imaging with isocentric C-arm"

1:50 Payman Rajai (Ph.D., U. Ottawa), "Feasibility of using backscattered light to recover refractive index gradient in biological samples"

2:10 Stéphanie Chiasson (M.Sc., Carleton U.), "Tc-99m/Tl-201 crosstalk correction on a dedicated cardiac CZT SPECT camera"

2:30 Rachel Timmins (M.Sc., Carleton U.), "Dual isotope cross-talk correction in quantitative small animal SPECT imaging"

2:50 Break with refreshments / Pause avec rafraîchissements

3:20 Karl Landheer (M.Sc., Carleton U.), "Coherent x-ray scatter projection imaging using an array of mono-energetic pencil beams"

3:40 Ken Moats (Ph.D., Carleton U.), "Signatures of Little Higgs Models at the Large Hadron Collider"

4:00 Dave McNamee (M.Sc., U. Ottawa), "Modeling forest ring patterns using a diagenetic approach"

4:20 Travis Martin (Ph.D., Carleton U.), "(Bestest) Little Higgs Model in light of LHC data"

Ottawa Carleton Institute for Physics Graduate Student Symposium: Spring 2012 - PART 2

Date: Tuesday, May 8, 2012
Time: 1:30 PM – 5:00 PM
Location: Azrieli Theatre, room AT-302

Abstract:

Ottawa Carleton Institute for Physics

L'Institut de physique d'Ottawa-Carleton

Spring 2012 Graduate Student Seminars – Afternoon 2

Tuesday May 8, 2012

1:30 PM – 5:00 PM

Azrieli Theatre, room AT-302

Carleton University

1:30 Nicholi Shiell (M.Sc., Carleton U.), "How to achieve good resolution with short integration time for Linear Collider TPC"

1:50 Nicolas Bigaouette (Ph.D., U. Ottawa), "Efficient many-body simulations used for laser-matter interaction in cluster environments"

2:10 Matthew Efseaff (M.Sc., Carleton U.), "Test-retest repeatability of myocardial blood flow measurements using Rb-82 PET imaging"

2:30 Shoaib Khan (M.Sc., Carleton U.), "Source localization using directional gamma ray spectrometer"

2:20 Michael Wong (Ph.D., U. Ottawa), "High harmonic spectroscopy of complex molecules"

3:10 Break with refreshments / Pause avec rafraîchissements

3:40 Lindsay Beaton (Ph.D., Carleton U.), "Predicting patient radiosensitivity: Looking for biomarkers in human leukocytes following ionizing radiation"

4:00 Azeez Omotayo (M.Sc., Carleton U.), "Investigation of calibration protocols for nanoDot optically stimulated luminescent detector (OSLD) use in clinical radiotherapy dose measurements"

4:20 Zengguang Qin (Ph.D., U. Ottawa), "Distributed vibration sensor based on phase sensitive optical time domain reflectometry"

4:40 Matthew Dunford (M.Sc., Carleton U.), "(Neutrinoless?) Double beta decay of Xe-136 at EXO200"

5:00 Eric Beamish (M.Sc., U. Ottawa), "Multiplexed detection of DNA and proteins using solid-state nanopores"

The emergence of scaling in QCD jets

Dr. Erik Gerwick

Date: Friday, May 11, 2012
Time: 2pm-3pm
Location: HP3230B (Faculty of Science Board Room)

Abstract:

Multi-jet rates are one of the most coveted LHC observables. In this seminar I present recent work developing a statistical understanding based on ratios of exclusive jet multiplicities. As analogies for the full QCD evolution, I relate a toy model for an iterated Poisson process, the final state cascade in the generating functional language, and the complete parton shower. Finally, I will mention possible experimental tests and applications for these methods highlighting improved jet veto predictions in Higgs searches.

Characterizing the Higgs at the LHC

Dr. Heather Logan

Associate Professor
Department of Physics, Carleton University

Date: Tuesday, May 29, 2012
Time: 3:30pm-4:30pm
Location: HP4351

Abstract:

The LHC experiments ATLAS and CMS have both observed signals consistent with a Standard Model Higgs boson with mass around 125 GeV. If these Higgs signals are confirmed, the next order of business will be to characterize the couplings of the new Higgs-like particle to other Standard Model particles. This will allow us to test whether the new particle really is the long-sought Higgs boson responsible for the masses of Standard Model particles. In this talk I'll describe the strategies for extracting Higgs couplings from LHC measurements and try to give some insight into the patterns of Higgs couplings that arise in extensions of the Standard Model Hig gs sector.