

# 2008-09 Physics Seminar Abstracts

## Search for Heavy Quarks Above the Top at Hadron Colliders

Anupama Atre  
Fermilab

**Location:** Herzberg 4351

**Date:** 2008-09-30

**Time:** 14:30-15:30

**Abstract:**

The discovery of the top quark at the Tevatron completed the three generations of fermions as the fundamental structure of matter fields in the Standard Model (SM). New vector-like quarks with sizable couplings to the SM quarks are a well-motivated extension of the SM, as they naturally appear in many theories beyond the SM. With the large data sample being accumulated, the CDF and D0 experiments at the Tevatron and the Large Hadron Collider are in a great position to search for heavier states at the high energy frontier. I will discuss the potential for discovery of heavy quarks above the "top" at hadron colliders.

Contact: Heather Logan

---

## "Two-minute seminars"

Faculty and postdocs  
Carleton University

**Location:** Herzberg 4351

**Date:** 2008-10-07

**Time:** 14:30-15:30

**Abstract:**

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

Each faculty member and postdoc should be prepared to give a two-minute presentation. This year we will try grouping the talks by research area.

Please send your updated slide to Kevin Graham.

---

## The European Roadmap for Particle Physics

Rolf Heuer  
Research Director, DESY Laboratory, Hamburg  
and Director-General Designate, CERN, Geneva

**Location:** Herzberg 4351

**Date:** 2008-11-04

**Time:** 10:30-11:30

**Abstract:**

Note unusual time.

---

## ==== Herzberg Lecture ====

# The Large Hadron Collider: Shedding Light on the Dark Universe

**Rolf-Dieter Heuer**  
Research Director, DESY Laboratory, Hamburg  
and Director-General Designate, CERN, Geneva

**Location:** Bell Theatre, Minto CASE

**Date:** 2008-11-04

**Time:** 19:30-20:30

**Abstract:**

Rolf-Dieter Heuer has been designated as the next Director General of CERN, the European Organization for Nuclear Research. He has contributed to the study of electron positron interactions, the development of experimental techniques, and the construction of large detector systems.

Despite great success, many key questions in particle physics and cosmology are unanswered. In particular, some 95% of the Universe consists of unknown dark matter and dark energy. Particle physics is about to enter the Terascale, providing a deeper understanding of the Universe and possibly dramatically changing our view of the world. With the start-up of the Large Hadron Collider at CERN this year, we expect revolutionary results explaining the origin of matter, unraveling the nature of dark matter and providing glimpses of extra spatial dimensions or grand unification of forces and hints on dark energy.

Professor Heuer is instrumental in shaping the European and international program in energy frontier physics. In this lecture, he will take a look into the future of particle physics.

This lecture is sponsored by the Faculty of Science and is free and open to the public.

---

## Search for Dark Matter with PICASSO

**Viktor Zacek**  
Universite de Montreal

**Location:** Herzberg 4351

**Date:** 2008-11-18

**Time:** 14:30-15:30

**Abstract:**

The nature of the main constituent of the matter content in the Universe is one of the outstanding puzzles of cosmology and astro-particle physics. PICASSO is one of the many ongoing experiments worldwide searching for Dark Matter and specialized on the detection of spin-dependent interactions of Weakly Interacting Massive Particles (WIMPs). Our detectors are based on phase transitions induced by nuclear recoils in superheated droplets. This technique is a promising alternative to other detector approaches and has several interesting background suppression features. The PICASSO collaboration is presently running an array of 32 detectors with an active mass of 3 kg at SNOLAB with the aim to increase substantially the sensitivity in the spin-dependent sector of neutralino interactions.

In this talk I will discuss the present status of Dark Matter research and the ongoing work in PICASSO to decrease radioactive backgrounds, increase the detector mass and its sensitivity.

Contact: Kevin Graham

---

## Collider signatures of strongly coupled electroweak models

**Veronica Sanz**  
Boston U.

**Location:** Herzberg 4351

**Date:** 2008-11-25

**Time:** 14:30-15:30

**Abstract:**

This blackboard talk is intended to be a pedagogical introduction to strongly interacting phenomena in the electroweak symmetry breaking sector. We will discuss related approaches to strong electroweak symmetry breaking (Extra-Dimensions, Technicolor, QCD-like resonance models...) and their LHC collider phenomenology.

Contact: Heather Logan

# OCIP Graduate Symposium -- Fall 2008 (Part 1)

**Location:** University of Ottawa [[campus map](#)]

**Date:** 2008-11-27

**Time:** 14:30-17:30

**Abstract:**

**In MacDonald 121:**

14h30: Nicole Fu, "Determining the evolution of high red-shift galaxies using multi-wavelength Canada-France-Hawaii Telescope and Spitzer data"

15h00: Daniel LaRussa, "The effect of cavity size and wall material on ion chamber response to Co-60 photon beams"

*15h30: Break with refreshments*

**In Fauteux 147A:**

16h00: Yun Li, "Brillouin scattering and its application in distributed sensing"

16h30: Elena Olariu, "Analysis of the diffusion attenuated magnetic resonance signal in white matter using a hydration layer model"

17h00: Alexander Walker, "Qualitative scanning spreading resistance microscopy development for 2D carrier profiling"

Contact: Gerald Oakham

---

## Top-Down Model Building for Cosmology

Andrew Frey

McGill University

**Location:** Herzberg 4351

**Date:** 2008-12-02

**Time:** 14:30-15:30

**Abstract:**

I will review why it is important to build models of cosmology starting from fundamental theories (as well as from more empirical concerns) and some of the progress of the last decade that has allowed us to build top-down models of cosmology. As an example, I will describe a model of dark matter from extra dimensions and discuss its prospects.

Contact: Heather Logan

---

# OCIP 2008 Christmas Symposium

**Location:** Carleton University, Room 360 Tory Building ("The Egg")

**Date:** 2008-12-09

**Time:** 09:30-13:00

**Abstract:**

9:30 a.m. - Michel Godin, "Weighing a single bacterium using a suspended micro-channel resonator"

10:00 a.m. - Richard Wassenaar, "Quantifying cardiac contraction abnormalities using SPECT"

10:30 a.m. - Karin Hinzer / Jeffrey Wheeldon, "Design and characterization considerations of high efficiency solar cells"

*11:00 a.m. - Break with refreshments*

11:30 a.m. - Rowan Thomson, "Monte Carlo dosimetry for eye plaque brachytherapy"

12:00 p.m. - Andrew Pelling, "Having your way with living cells"

12:30 p.m. - David Sinclair, "EXO: A search for neutrinoless beta decay"

*Lunch at 1:00 p.m.*

Contact: Gerald Oakham

---

## POSTPONED to January 2009 (Title TBA)

Steve Robertson  
McGill University

**Location:** Herzberg 5115

**Date:** 2008-12-09

**Time:** 14:30-15:30

**Abstract:**

(tentative date)

Contact: Kevin Graham

---

## OCIP Graduate Symposium -- Fall 2008 (Part 2)

**Location:** Carleton University, Room 360 (The Egg), Tory Building

**Date:** 2008-12-12

**Time:** 13:30-17:00

**Abstract:**

1:30 p.m. - Jesse Smith (U. Ottawa), "The high-pressure structure and lattice dynamics of the heavy alkaline earth hydrides"

2:00 p.m. - Sorina Truica (Carleton U.), "Non Contrast Perfusion Measurements in Abdominal MR Imaging"

2:30 p.m. - Dawn Fraser (U. Ottawa), "Functional robustness of the embryonic stem cell switch"

3:00 p.m. - *Break with refreshments*

3:30 p.m. - Ryan Bolen (U. Ottawa), "Polarization dependent optical frequency domain reflectometry for distributed sensing applications"

4:00 p.m. - Brian King (Carleton U.), "Methods for Measuring X-ray Coherent Scattering Form Factors of Tissues"

4:30 p.m. - Michael Reimer (U. Ottawa), "Gated quantum dots: A scalable route to generating entangled photon pairs"

Contact: Gerald Oakham

---

## Fresh news from ATLAS

**David Cote**

**DESY**

**Location:** Herzberg 4351

**Date:** 2009-01-06

**Time:** 14:30-15:30

**Abstract:**

Working on ATLAS is very exciting these days! After many years of preparation, the ATLAS detector was finally completed, in time to record the very first "splash" and circulating beam events from the LHC. Since then, we have also been taking cosmic data with the complete ATLAS detector. Following these spectacular successes, the expectation of imminent LHC collisions pushed ATLAS out of a preparation phase, into an operational one. Even though ATLAS was generally ready to operate during stable LHC collisions, this showed that important items would have been missing to operate as smoothly as desired, until a large helium leak severely damaged the LHC on September 19th. In this talk, I will review the current status of ATLAS and sketch what will probably happen when the LHC restarts this spring. I will also mention some of the "missing items" from September, taking the ATLAS reconstruction and DPD software as examples in which I have been personally involved.

Contact: Gerald Oakham or Heather Logan

---

# Towards real-time protein identification using the Cell BE Processor

Jim Green  
Carleton University, Engineering

**Location:** HP 4351

**Date:** 2009-01-20

**Time:** 14:30-15:30

**Abstract:**

Mass spectrometry (MS) is a key proteomics analytical technique. However, the present decoupling of the data collection stage, from the protein identification stage, leads to missed scientific opportunities and limits the effectiveness of MS since the data analysis is relegated to be offline and 'after the fact'. In this talk, we will discuss how IBM's heterogeneous multi-core Cell BE processor, developed for the Sony PS3, can be used to accelerate the protein identification stage to enable real-time control of a MS device. As a concrete example, preliminary results will be given on leveraging the multiple levels of parallelism of the Cell BE processor to identify tryptic digest points in the human proteome.

Contact: Dave Rogers

---

# U(1)'-extended Supersymmetric Standard Model

Hye-Sung Lee  
University of California, Riverside

**Location:** Herzberg 4351

**Date:** 2009-01-27

**Time:** 14:30-15:30

**Abstract:**

Higgs is introduced in the Standard Model to explain the masses for the fermions and gauge bosons. The mass of the Higgs itself becomes divergent when the quantum corrections are included, and it requires a new physics beyond the Standard Model to solve this problem. Supersymmetry (SUSY) is a prevailing new physics scenario that can solve this problem naturally. However, mere supersymmetrization of the Standard Model has other issues such as proton decay problem and dark matter candidate decay problem, and it demands another mechanism or a "SUSY companion symmetry". R-parity is a popular SUSY companion symmetry that can address the stability of the proton and dark matter candidate with a single discrete symmetry, and the R-parity conserving SUSY model has been widely studied. However, R-parity is not the only option for such a property. We will see how a TeV scale extra U(1) gauge symmetry can replace the R-parity. The residual discrete symmetries of the extra U(1) gauge symmetry can make the model still viable and attractive with distinguishable phenomenology especially in the upcoming collider experiments.

Contact: Heather Logan

---

# Particle masses, spins and couplings at hadron colliders

Kyoungchul Kong  
Fermilab

**Location:** Herzberg 4351

**Date:** 2009-02-03

**Time:** 14:30-15:30

**Abstract:**

I will outline a general strategy for measuring spins, couplings and mixing angles in the case of a heavy partner decay chain terminating in an invisible particle. If time permitted, I will also introduce a global variable for determining the mass scale of new physics, and discuss a generalization of MT2 method for complete mass determination.

Contact: Heather Logan

---

# Non-standard phenomenology at the LHC

Thomas Gregoire  
U. Edinburgh

**Location:** Herzberg 4351

**Date:** 2009-02-09

**Time:** 15:00-16:00

**Abstract:**

\*\*\* Note unusual day and time \*\*\*

The LHC will soon start operating with the promise of answering many questions about particle physics, especially about the breaking of the electroweak symmetry. It will look for the Higgs boson as well as for new physics such as supersymmetry or little Higgs models, that could make the mass of this scalar particle natural. In this talk I will examine situations where the identification of the Higgs or supersymmetry might be difficult. In particular I will discuss the possibility for the Higgs branching to be modified and look at a non-standard decay mode of the Higgs to leptons and missing energy. I will argue that standard LHC Higgs searches could also identify this mode. Then I will present a situation where a little Higgs model could contain gaugino-like states and look similar to a supersymmetric model.

Contact: Heather Logan

---

# Imaging with impedance

Andy Adler  
Department of Systems and Computer Engineering, Carleton University

**Location:** Herzberg 4351

**Date:** 2009-02-24

**Time:** 14:30-15:30

**Abstract:**

Electrical impedance tomography (EIT) tries to calculate the distribution of impedance within a body from electrical stimulation and measurement at the body surface. EIT is used in geophysics (subsurface imaging), industrial process tomography (pipe flow and mixing tanks), and for medical imaging (lungs, heart, breast, brain). My research focus is on EIT imaging of the lungs, where the primary application is to monitor mechanically ventilated patients to see changes in the gas distribution. The key technical challenges are due to the ill-posed nature of the physics of EIT: measurements are much more sensitive to changes near the electrodes than to those deeper inside the body. This talk will give a brief overview of our approaches to deal with issues such as movement of electrodes due to breathing and posture change, and changes in electrode contact impedance over time.

Contact: Dave Rogers

---

# New Sources of X-ray Imaging Contrast

Dean Chapman  
University of Saskatchewan

**Location:** Herzberg 4351

**Date:** 2009-02-27

**Time:** 15:45-16:45

**Abstract:**

\*\*\* Note unusual day and time \*\*\*

New sources of x-ray imaging contrast that rely on phase or phase related effects have been developed in the past several years, primarily at synchrotron facilities. One of the techniques that exploit these contrast mechanisms is Diffraction Enhanced Imaging (DEI). This method develops subject contrast from x-ray refraction and ultra-small angle x-ray scattering (USAXS) as well as the usual x-ray attenuation and is easily applied using synchrotron x-ray sources. These types of x-ray imaging contrast have been shown to be useful for soft tissue imaging. The physics of these contrast mechanisms, the elements of the imaging system, algorithms used to extract object information, and experimental verification will be presented. Examples of the contrast and applications to mammography, cartilage and joint imaging, small animal imaging will be presented. Some progress has been made in developing laboratory based systems which capitalize on this type of imaging and examples of imaging with them will be given along with some details of the arrangements used. Finally, a dedicated biomedical imaging and therapy (BMIT) beamline is nearing completion at the Canadian Light Source in Saskatoon. Examples of the type of research which is just beginning there will be used in the presentation along with a brief description of the beamline layout and plans for the facility.

Contact: Bog Jarosz

---

# Atmospheric Radionuclide Monitoring at Health Canada for the Comprehensive Nuclear-Test-Ban Treaty and the well being of Canadians

Trevor Stocki  
Radiation Protection Bureau, Health Canada

**Location:** Herzberg 4351

**Date:** 2009-03-03

**Time:** 14:30-15:30

**Abstract:**

Since January 1959, Health Canada has been active in the measurement of radioactive fallout on air filters, to ensure the health and well being of Canadians. This work has evolved to include an active role in achieving a comprehensive ban on the testing of nuclear weapons. Compliance verification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) employs radioactive aerosol and noble gas monitoring, in particular radon. Health Canada has operated CTBT test monitoring stations for particulate in Vancouver since April, 1996 and for particulate and noble gas in Ottawa since November, 2001. The noble gas station measures the concentration activity of radon through the use of a SPALAX (Système de Prélèvement d'air Automatique en Ligne avec l'Analyse des radonXénon).

Ottawa has a complex radon environment due to the proximity of nuclear power reactors, research reactors, and medical isotope facilities. This complex environment provides an ideal testing ground for radon detection, which in turn provides an excellent area to develop and research a CTBT event classification methodology.

In addition to the CTBT mandate, a real-time radiation monitoring network of Canadian nuclear facilities and major population centres is being implemented for response to the events of September 11th. This network consists of NaI(Tl) detectors which face skyward to measure gamma radiation from airborne radioactivity, in particular radioactive noble gases. These detectors are set up to measure air KERMA rate.

With stations from both networks co-located in Ottawa, it has provided the unique opportunity to intercompare them. Monte Carlo simulations of the air KERMA rate at the centre of a radioactive cloud have been run to better understand the intercomparison.

The combination of these two networks is an excellent scientific tool for the testing of meteorological models which would be employed in the event of an incident.

Contact: Tong Xu

---



# The Origin of Neutrino Masses and Physics Beyond the Standard Model

Pavel Fileviez Perez  
University of Wisconsin - Madison

**Location:** Herzberg 5115 \*\*\* note unusual room! \*\*\*

**Date:** 2009-03-10

**Time:** 14:30-15:30

**Abstract:**

The existence of massive neutrinos in the Universe is one of the motivations for physics beyond the Standard Model. A mechanism for spontaneous R-parity violation in the context of supersymmetric theories is presented and I discuss the possibility to test the seesaw mechanism at the Large Hadron Collider. The impact of the mechanism for neutrino mass generation on the idea of grand unification with and without supersymmetry is analyzed, presenting a new grand unified theory called Adjoint SU(5). I show the possible predictions coming from these theories which could be tested at future non-accelerator experiments or at the Large Hadron Collider.

Contact: Heather Logan

---

**(no seminar)**

**Date:** 2009-03-17

**Time:** 14:30-15:30

**Abstract:**

**Status:** TENTATIVE

---

## === Canadian Association of Physicists Annual Lecture === Black Holes and the Problem of Information Loss

Prof. Saurya Das  
University of Lethbridge

**Location:** Azrieli Theatre 301

**Date:** 2009-03-20

**Time:** 10:00-11:00

**Abstract:**

Starting from two fundamental principles of physics, namely the maximum speed of propagation of signals (speed of light) and reference frame independence of this speed, we arrive at the notion of spacetime continuum and the metric. When we try to incorporate acceleration or gravity in this picture, we show that spacetime must be curved. The amount of curvature depends on the matter content of the spacetime, and is governed by the Einstein equations. These equations also predict the existence of black holes - highly dense gravitating objects, from which (classically) nothing can escape, not even light. When quantum mechanics is taken into consideration, black holes are predicted to emit small amounts of thermal radiation and have large amounts of entropy. This also gives rise to the so-called 'information loss problem', which says that information entering a black hole maybe lost forever, in apparent violation of quantum mechanics. We explore possible microscopic origins of black hole entropy and possible resolutions of the information loss problem.

---

# Call for a Superdark Moose in a Hidden Valley

Pauline Gagnon

**Location:** Herzberg 4351

**Date:** 2009-04-07

**Time:** 14:30-15:30

**Abstract:**

Much has been written over the past few months following the observation reported by the PAMELA experiment of an anomalous flux of high energy positrons. Many models, both from astrophysics and particle physics, have attempted to provide an explanation to this observation. Many have claimed this could be due to dark matter annihilation. But some theorists have even proposed a new theory that attempts to resolve in one go all known anomalies reported in astrophysics over the recent years. I will first review these anomalies, then will describe this new theory and show how it offers interesting and exciting possibilities in the context of Hidden Valley models. I will conclude showing how this could be tested at existing hadron and e+e- colliders.

Contact: Kevin Graham

---

# IceCube/DeepCore - A New Window to the Dark Universe

Darren Grant  
Pennsylvania State University

**Location:** Herzberg 4351

**Date:** 2009-07-15

**Time:** 15:00-16:00

**Abstract:**

Astronomical measurements have clearly demonstrated that the Universe is almost completely dark with only 4% of the total energy density visible as ordinary baryons and radiation. The remainder is thought to be composed of Dark Matter and Dark Energy, with refined measurements providing an estimate of the relative concentrations at 22% and 74%, respectively. The nature of these two components remains very much a mystery, although favoured theories have come forward. Some of these may be readily testable through experimental measurements, including that of Dark Matter being comprised of Weakly Interacting Massive Particles (WIMPs).

The IceCube Neutrino Observatory is a cubic-kilometer scale neutrino detector being constructed in the Antarctic ice near the South Pole Station. Designed as a telescope to search for very high energy neutrinos from astrophysical sources, the detector may also be applied to the search for WIMP Dark Matter indirectly, via neutrinos produced in WIMP annihilations. In this talk I will discuss the mechanism for such a measurement and present the first results of WIMP searches using IceCube. I will also discuss my work with the DeepCore, a new sub-detector for IceCube, designed to lower the energy threshold of the IceCube detector by more than an order of magnitude. This new energy reach opens a window to a potential wealth of neutrino physics and significantly increases the sensitivity for WIMP searches.

Contact: Heather Logan