Past Physics Seminar Calendar: 2005-2006

Thermalization after inflation in supersymmetry

Rouzbeh Allahverdi,
TRIUMF

Location: HP 4351

Contact: Heather Logan

Date: 2005-09-13
Time: 15:30-16:30
Abstract:

In the context of inflationary cosmology all of the matter in the universe is created during reheating. Reheating starts with the inflaton decay and eventually results in a thermal bath consisting of elementary particles. I will discuss modifications in thermal history of the universe that arise in supersymmetric theories. I will particularly highlight the fact that thermalization can be an extremely slow process and result in reheat temperatures as low as O(TeV). Consequences for thermal gravitino production and leptogenesis will be discussed.

Status: CONFIRMED

Small Animal Positron Emission Tomography for Research in Heart Disease

Rob deKemp,
Ottawa Heart Institute

Location: Herzberg Physics 4351

Date: 2005-09-20
Time: 15:30-16:30
Abstract:

Positron emission tomography (PET) has been used clinically to measure perfusion, enzyme reactions, ligand-receptor interactions, cellular metabolism and cell proliferation. Until recently, PET has not been suitable for small animal models because of limitations in spatial resolution. Development of micro-PET scanners for small animal imaging and the availability of PET tracers has made this technology accessible for the non-invasive, quantitative and repetitive imaging of biological function in rats and mice. The development of new molecular probes and PET-based reporter genes has extended micro-PET applications of metabolism, enzyme activity, receptor-ligand interactions, protein-protein interactions, gene expression, cell therapy and gene therapy. These investigations in small animals can be translated rapidly to clinical research and clinical practice, because the techniques can be scaled easily for human use.

Contact: Dave Rogers

Status: CONFIRMED

Meeting to discuss TRIUMF priorities document

Location: Herzberg Physics 4351

Date: 2005-09-27
Time: 16:00-16:30
Abstract:

The director of TRIUMF has requested input on what should be the priorities of the TRIUMF lab over the next five years. A copy of the documentation and survey is in the coffee room. We should submit a summary of comments at the end of September.

Contact: Manuella Vincter

Status: CONFIRMED

Light Meson Spectroscopy, Revisted

Jim Napolitano
Rensselaer Polytechnic Inst.

Location: HP 4351

Date: 2005-10-11
Time: 15:30-16:30
Abstract:

A number of years ago, Steve Godfrey and I reviewed the theoretical and experimental situation in the spectroscopy of light mesons. We showed that there were many elegant ways in which theory and experiment agreed. However, we also identified a number of cases where the comparison pointed to new ways of understanding the data. Some of these cases seemed to involve degrees of freedom beyond the quark model.

We will discuss several advances since this review, including the evidence for non qq-bar degrees of freedom. We'll also consider prospects for continuing this research in the future.

Contact: David Asner

Status: CONFIRMED

"Two-Minute Seminar"

Location: Herzberg Physics 4351

Date: 2005-10-18
Time: 15:30-16:30
Abstract:

Every year we like to hold a meeting to introduce ourselves to any new people in the department. Everyone gets two minutes to describe who they are and what they do. New faculty members, RAs and grad students are especially invited!

Status: CONFIRMED

The Confrontation Between General Relativity and Experiment: A Centenary Perspective

Clifford M. Will
McDonnell Center for the Space Sciences, Department of Physics
Washington University, St. Louis, USA

*** OCIP Lecture ***

Location: Steacie 103

Date: 2005-10-21
Time: 14:00-15:00
Abstract:

We review the experimental evidence for Einstein's general relativity. Tests of the Einstein Equivalence Principle support the postulates of curved spacetime, while solar-system experiments strongly confirm weak-field general relativity. The Binary Pulsar provides tests of gravitational-wave damping and of strong-field general relativity. We describe ongoing and future experiments, such as the recently completed Stanford Gyroscope Experiment, a satellite test of the Equivalence principle, and tests of gravity at short distance to look for extra spatial dimensions. Recently operational laser interferometric gravitational-wave observatories, and a future space interferometer, may provide new tests via the properties of gravitational waves.

Contact: Paul Johns

Status: CONFIRMED

Was Einstein Right?

Clifford M. Will
McDonnell Center for the Space Sciences
Department of Physics
Washington University, St. Louis

*** Special Public Lecture ***

Location: Marion Hall Auditorium, University of Ottawa, 140 Louis Pasteur

Date: 2005-10-22
Time: 19:00-20:00
Abstract:

How has the most celebrated scientific theory of the 20th century held up under the exacting scrutiny of planetary probes, radio telescopes, and atomic clocks? After 100 years, was Einstein right? In this lecture, celebrating the 100th anniversary of Einstein's "miracle year" and the World Year of Physics, we relate the story of testing relativity, from the 1919 measurements of the bending of light to the 1980s measurements of a decaying double-neutron-star system that reveal the action of gravity waves, to a 2004 space experiment to test whether spacetime "does the twist". We will show how a revolution in astronomy and technology led to a renaissance of general relativity in the 1960s, and to a systematic program to try to verify its predictions. We will also demonstrate how relativity plays an important role in daily life.

The evening will commence with music provided by The Borealis String Quartet. Selections will include "Water to Ice", a specially commissioned musical composition written by Aaron Hryciw, a Ph.D. physics student at the University of Alberta, in recognition of 2005 as the World Year of Physics.

Admittance is free, but registration is recommended. Please register on the web at http://www.cap.ca/wyp/tour-list.asp.

Sponsored by Perimeter Institute, Canadian Association of Physicists, University of Ottawa, Carleton University, Canadian Museum of Science & Technology, Canadian Astronomical Society, Canadian Meteorological and Oceanographic Society, Canadian Organization of Medical Physicists, Industry Canada, NSERC, and NRC.

Status: CONFIRMED

Measuring changes in the tumor micro-environment *in vivo* in order to improve cancer treatment strategies

Greg Cron

Laboratory of Biomedical Magnetic Resonance
Catholic University of Louvain
Brussels

Date: 2005-10-24
Time: 11:00-12:00
Abstract:

Tumor cells *in vivo* are surrounded and supported by interstitial fluid, capillaries, and other various elements. This so-called "tumor micro-environment" is often hypoxic and poorly perfused (low blood flow), greatly reducing the efficacy of radiation therapy and chemotherapy. By studying how the characteristics of this micro-environment (esp. oxygen levels and perfusion) change with time in response to therapies and co-drugs, it is possible to develop more intelligent treatment strategies which should ultimately benefit the patient. For example, there is a lack of data regarding how tumor oxygen and perfusion change in response to low dose rate brachytherapy. This may be why some clinical issues remain unresolved, such as the appropriate use of adjuvant external beam radiation therapy. The purpose of the first half of Dr. Cron's post-doctoral work (completed and published in early 2005) was to obtain some basic pre-clinical data on how

oxygen and perfusion evolve *in vivo* in response to such brachytherapy treatments. The tools used for that work were electron paramagnetic resonance oxymetry and dynamic contrast-enhanced magnetic resonance imaging. The purpose of the second half of Dr. Cron's work (ongoing) was to develop quantitative *in vivo* ^{19}F spectroscopy and imaging for studying the penetration, elimination, and distribution of fluorinated chemotherapy drugs in tumors (a measure of perfusion with direct relevance to treatment).

Contact: Paul Johns

Status: CONFIRMED

The challenge of electron dosimetry in the 80-130 keV energy range

Malcolm McEwen
Ionizing Radiation Standards
National Research Council of Canada

Location: Herzberg Physics 4351

Date: 2005-11-01
Time: 15:30-16:30
Abstract:

Radiation sterilization of medical devices is usually carried out using penetrating radiation from cobalt-60 gamma sources or accelerated electrons in the energy range 2-10 MeV. However, as well as sterilizing, the radiation also negatively affects the properties of the irradiated materials (radiation damage). One approach is to use a low-energy electron beam (~ 100 keV) where only the surface of the product is irradiated, thereby killing the micro-organisms without changing the properties of the product. An additional advantage is that the technology for the production of such beams is also much simpler. Legal requirements for the sterilization of medical goods set out minimum dose levels, which means that all dosimetry must be traceable to national or international standards. At present national standards for absorbed dose are established for penetrating radiation (cobalt-60 gamma or high-energy electron or X-rays) but they are not established for low-energy electron beams. The current practice is therefore to calibrate the dosimeters used - typically thin films -- at high energies assume that the calibration factor is energy independent. This assumption remains untested. This presentation will discuss the development of a primary standard and calibration method for high-dose electron beams in the energy range 80-120 keV and highlight the problems (inherent and encountered) in these measurements. Detailed knowledge of radiation dosimetry is not required!

Contact: Dave Rogers

Status: CONFIRMED

The wonders of supersymmetry: from quantum mechanics, topology, and noise to (maybe) the LHC

Erich Poppitz
University of Toronto

Location: Herzberg Physics 4351

Date: 2005-11-22
Time: 15:30-16:30
Abstract:

I will introduce supersymmetry, a new quantum mechanical symmetry between bosons and fermions, in the simple setting of supersymmetric quantum mechanics. Its sufficiently rich structure will allow me to illustrate the uses of supersymmetry in mathematics, topology, and stochastic differential equations, and also discuss the important properties that make supersymmetry an interesting ingredient for models of the elementary particles.

Contact: Heather Logan

Status: CONFIRMED

Real-time tumor tracking using implanted positron emission markers: concept and simulation study

Tong Xu
Dept. of Radiological Sciences
University of California at Irvine

Location: Herzberg Physics 4351

Date: 2005-11-23
Time: 10:00-11:00
Abstract:

Contact: Paul Johns

Status: CONFIRMED

(Title TBA)

Steve Robertson
McGill University

Location: HP 4351

Date: 2005-11-29
Time: 15:30-16:30
Abstract:

Contact: David Asner

Status: TENTATIVE

Magnetic Resonance Imaging of the Lungs using Hyperpolarized Noble Gases

Juan Parra-Robles
Imaging Research Laboratories
Robarts Research Institute
London, Ontario

Location: Herzberg Physics 5115 **note nonstandard room**

Date: 2005-12-09
Time: 12:15-13:15
Abstract:

Hyperpolarized noble gases (HNG) have become promising contrast agents for lung magnetic resonance (MR) imaging. MR parameters, such as the apparent transverse relaxation time (T2*) and apparent diffusion coefficient (ADC) are sensitive to the geometric and magnetic properties of the airways and can be used to estimate the dimensions and geometry of the airways which may provide a means of diagnosing lung diseases. To investigate the field dependence of relaxation and diffusional properties of these gases and validate the performance of the different techniques used for ADC and T2* measurements, a phantom with geometric and magnetic properties similar to the airways is needed. Furthermore, until now, the choice of field strength and magnet geometry for HNG imaging has been dictated by the magnet hardware available for conventional clinical proton MR systems, despite evidence that lower fields provide advantages such as: increased patient accessibility, reduced cost and reduced image artifacts. Dedicated low-field HNG MR systems have been developed but their field strength selection has not been optimized in any comprehensive way. In this presentation, a theoretical framework for the design of an optimized clinical HNG MR imaging system based on models of the field strength dependence of the achievable signal-to-noise ratio and spatial resolution will be discussed. Experimental validation of this theory using noise analysis and xenon and helium images of phantoms and rat lungs in vivo will also be presented. Preliminary theoretical modeling and experimental estimation of T2* and ADC will be described. These experiments were performed on phantoms that use the capillary tubing in dialysis modules to simulate the geometric, magnetic and gas exchange properties of lung airways. Finally, current and future research plans will be briefly discussed.

Contact: Paul Johns

Status: CONFIRMED

Seeing Beauty with the Collider Detector at Fermilab

Andreas Warburton
McGill University

Location: Herzberg Physics 4351

Date: 2005-12-13
Time: 15:30-16:30
Abstract:

The world's highest-energy operating particle collider, the Tevatron accelerator complex at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois, is providing symmetric collisions of protons on antiprotons at a centre-of-mass energy near 2 TeV. The upgraded Collider Detector at Fermilab (CDF II) is one of two multipurpose detectors pursuing a rich physics program using these high-energy hadronic collisions. The beauty, or bottom, quark forms a key component of many aspects of this program by virtue of its profound links to the strong and weak forces at vastly disparate energy scales. In this talk I will explore selected important features of beauty physics that are uniquely accessible to the Tevatron, including the hadroproduction of b jets with high transverse momentum and the formation and decay of heavy b mesons. The talk will include recent CDF results extracted from the early Run II data collected to date and a discussion of their significance to our understanding of the physics of b quarks at high-energy hadron colliders.

Contact: David Asner

Status: CONFIRMED

The Impact on the Physicist's Workload of Increased Resolution in External Beam Radiation Therapy

Brenda Clark
Ottawa Regional Cancer Centre

Location: HP 4351

Date: 2006-01-10
Time: 15:30-16:30
Abstract:

Over the last 10 years or so, there has been a dramatic increase in the sophistication and complexity of radiation therapy techniques driven largely by advances in linear accelerator technology and treatment planning software. In particular, higher resolution imaging and the addition of electronically controlled beam shaping devices has resulted in increased ability to identify and conform dose to target volumes thus sparing proximal healthy tissue. With these improvements came a commensurate opportunity and requirement for medical physicists to specify, characterize and verify the resulting highly structured dose distributions. This presentation will describe some analytical and experimental techniques developed to ensure optimal dose delivery in external beam radiation therapy.

Contact: Dave Rogers

Status: CONFIRMED

Biomedical Imaging with Light and Ultrasound: Imaging of Gene Expression, Blood Oxygenation, and Beyond

Roger Zemp
Optical Imaging Laboratory
Dept. of Biomedical Engineering
Texas A & M University

Location: Herzberg Physics 4351

Date: 2006-02-01
Time: 13:00-14:00
Abstract:

Biomedical optical imaging offers great promise for visualizing functional and molecular information in vivo. Limited penetration and multiple scattering of light, however, present challenges for high resolution imaging at depths beyond a transport mean-free path. Photoacoustic imaging is an emerging modality that offers optical contrast with the ultrasonic spatial resolution. In photoacoustic imaging, short laser pulses with high pulse energy illuminate biological tissues. Light absorption induces a rapid thermoelastic expansion producing ultrasound signals that are detected and reconstructed to form images representative of optical absorption. Moreover, using multiple wavelength illumination it is possible to use spectral absorption information to estimate distributions of the dominant endogenous absorbers in tissue: oxy-hemoglobin and deoxy-hemoglobin. Exogenous contrast agents or reporter gene products also offer the possibility to perform molecular imaging. I will report on recent results showing progress towards imaging of oxygen saturation and imaging of gene expression with photoacoustic tomography and microscopy, and discuss technical considerations of these exciting new techniques. Photoacoustic imaging promises to open new windows for basic science and diagnostic medicine, and may have important implications for the future of medical discovery.

Contact: Paul Johns

Status: CONFIRMED

The Nature and Origin of Cosmic Rays

Stephane Coutu
Penn State University

Location: Herzberg Physics 5115 **note nonstandard room**

Date: 2006-02-02
Time: 15:30-16:30
Abstract:

Conventional wisdom holds that the majority of high energy atomic nuclei ("cosmic rays") that continually rain upon the Earth originate in galactic supernova shock waves, although some different (likely extragalactic) origin must be invoked to explain the highest energy particles. Despite many decades of intensive research on the subject, only indirect clues to these ideas exist at present. Direct measurements of the spectrum and mass composition of high energy cosmic rays are needed to validate these notions, but are hampered by rapidly dwindling fluxes with energy. Indeed, there is an expectation that the cosmic nuclei should have progressively more charge (and therefore mass), on average, with increasing energy, up to the astrophysical "knee" (spectral break) in the spectrum at around 3x10^15 eV. At energies beyond the knee, only indirect measurements are possible.

The CREAM (Cosmic Ray Energetics And Mass) experiment is a complex particle detector flown by high altitude balloon to directly measure the charge and energy of the cosmic rays at energies near the spectral knee. It flew successfully in Antarctica in Dec 04 / Jan 05 for a record-breaking 42 days, and again in Dec 05 / Jan 06. We will review the science and performance of the instrument in flight, and present the status of the ongoing data analysis and prospects for additional CREAM missions.

The Auger experiment is the largest cosmic ray detector ever built, currently nearing completion in Argentina, covering an area of 3000 km^2. Its aim is to resolve a number of mysteries surrounding the highest energy cosmic rays, beyond

10^18 eV, whose very existence and ability to reach the Earth are difficult to understand. The rareness of the highest energy particles has precluded definitive answers to the question of their nature and origin, and indeed some controversy surrounds the existing experimental evidence. The Auger experiment will afford an order of magnitude improvement in statistics over previous efforts, as well as much improved control of systematics. We will review the science of the highest energy cosmic rays and present first results obtained with the growing Auger array, and discuss plans for the future of these efforts.

Contact: Alain Bellerive

Status: CONFIRMED

Precision physics at the LHC

Frank Petriello
University of Wisconsin, Madison

Location: Herzberg Physics 4351

Date: 2006-02-28
Time: 15:30-16:30
Abstract:

Experiments at the Large Hadron Collider (LHC) will provide our first look at the mechanism of electroweak symmetry breaking, which gives mass to elementary particles. I describe several theoretical obstacles which must be overcome to understand information from LHC experiments. I focus on our understanding of Quantum Chromodynamics (QCD), the theory of the strong nuclear force. Theoretical uncertainties arising from our inability to calculate precisely in QCD may hinder our ability to properly interpret experimental data. I describe recent progress in understanding the perturbative structure of QCD, and present applications to LHC physics.

Contact: Heather Logan

Status: CONFIRMED

Development of Cryogenic Tracking Detectors for low-energy Solar Neutrinos

Raphael Galea
Columbia University

Location: Herzberg 5115 ** note unusual room **

Date: 2006-03-02
Time: 16:00-17:00
Abstract:

** Note time: the talk starts at 4:00 pm **

The measurements made in Solar Neutrino physics have produced some of the most exciting results in physics in the past decade. Yet, over 90% of the solar neutrino flux, those coming from proton-proton fusion reactions in the sun, have not been detected in real-time. This talk will outline the design of a novel new detector which is being developed to measure these low energy neutrinos from the sun. This tracking detector will use Cryogenic Noble liquids, and the properties of 'electron bubbles' to detect these elusive particles.

Contact: Paul Johns

Status: CONFIRMED

Proposal for a paradigm shift in CT dosimetry

Walter Huda

Dept of Radiology
SUNY Upstate Medical University
Syracuse, NY

Location: Herzberg Physics 4351

Date: 2006-03-07
Time: 15:30-16:30
Abstract:

The current method of CT dosimetry is based on the computed tomography dose index (CTDI), obtained by performing a line integral of the dose profile from a single CT section. Derived CT dose descriptors include a weighted CTDI, volume CTDI, as well as a dose-length product. The current approach to CT dosimetry is complex, and there are ambiguities regarding the definition and interpretation of most CTDI dose descriptors. Furthermore, the advent of multi-detector CT with wide x-ray beams will result in practical difficulties to measurement of dose profiles that will exceed the length of current pencil dosimeter (i.e., 100 mm).

A radical revision to CT dosimetry is proposed that eliminates all CTDI metrics, as well as the acrylic phantoms in which CT dose profiles are measured. The radiation output of the CT scanner may be determined by measuring the iso-center air kerma (free-in-air) KCT. Localized doses in patients may be obtained by combining output data with CT tissue air ratios (TAR) obtained from phantom measurements. The total amount of radiation received by the patient may be specified as the air kerma-area product (PKA) incident on the patient that is straightforward to measure or calculate. Conversion factors obtained through Monte Carlo calculations can be used to covert PKA values into corresponding effective doses for patients whose size can range from newborns to adults.

Contact: Dave Rogers

Status: TENTATIVE

Solar neutrinos and beyond with the Sudbury Neutrino Observatory

David Waller

Carleton University

Location: Herzberg 5115 **note unusual room**

Date: 2006-03-08
Time: 16:30-17:30
Abstract:

** Note the talk starts at 4:30 p.m. **

The Sudbury Neutrino Observatory (SNO) is a 1000 tonne heavy water Cherenkov detector located 2km underground in INCO Ltd's Creighton Mine, near Sudbury, Ontario. The experiment has been taking neutrino data since 1999. Previous SNO results on 8B solar neutrinos have revolutionized our understanding of neutrino flavour change and solved the 30-year old Solar Neutrino Problem. Besides 8B neutrinos, SNO is sensitive to other interesting sources of neutrinos. Two such sources are solar neutrinos from the fusion of 3He and a proton (Hep neutrinos), and the Diffuse Supernova Neutrino Background. SNO is uniquely sensitivity to these rare, and as yet undetected, neutrinos.

After an overview of the SNO detector and SNO's previous 8B solar neutrino results, the prospects for measuring Hep neutrinos and the Diffuse Supernova Neutrino Background will be discussed. The remainder of the seminar will provide a brief look at the future of SNO.

Contact: Paul Johns

Status: CONFIRMED

Inclusive b-quark Decays and the Search for New Physics

Andrzej Czarnecki
University of Alberta

Location: Herzberg 4351

Date: 2006-03-20
Time: 10:15-11:15
Abstract:

For more than a decade there has been a puzzling disagreement between the predicted and the measured inclusive branching ratios of the b-quark: the observed proportion of semileptonic decays was falling short of the Standard Model prediction. Since the b-quark decays are suppressed in the Standard Model, there have been speculations that there may be a New Physics mechanism that distorts the proportions of decay channels. We have found a class of QCD effects which enhance the hadronic b-quark decay rate by about 5-8% and thus qualitatively solve the puzzle. In that study, a new method for computing four-loop diagrams has been developed which can be further used to make the semileptonic branching ratio a truly precise tool for New Physics searches. Related computational methods can also be used in atomic spectroscopy. I will present an application to the bound-electron magnetic moment from which we have recently extracted the most precise value of the electron mass.

Contact: Bruce Campbell

Status: CONFIRMED

Neutrino Oscillations and the T2K Experiment

Juergen Wendland
University of British Columbia

Location: Herzberg 4351

Date: 2006-03-20
Time: 13:15-14:15
Abstract:

Results from a variety of neutrino experiments firmly establish that neutrinos are massive and that they undergo flavor oscillation. The Super-Kamiokande collaboration has reported conclusive evidence for neutrino oscillations of atmospheric neutrinos. The direct observation of solar electron neutrino transformation into other neutrino flavors by the Sudbury Neutrino Observatory (SNO) has explained the long standing solar neutrino problem. The on-going third phase of the SNO experiment will provide further constraint on the solar neutrino mixing parameters. However, next generation experiments are required for a complete description of three flavor neutrino mixing. The Tokai-to-Kamioka (T2K) experiment is an upcoming long baseline neutrino oscillation experiment designed to measure neutrino oscillation in a muon neutrino beam. Precision measurements of muon neutrino disappearance will improve present data by an order of magnitude and measurements of electron neutrino appearance will link the atmospheric and solar oscillation regimes. In this seminar I will review the status of neutrino oscillation physics and discuss the physics goals and current status of the T2K experiment.

Contact: Paul Johns

Status: CONFIRMED

The A-B-C's of Monte Carlo in radiotherapy: Applications and Benchmarks

Bruce Faddegon, UCSF

HP 4351

Date: 2006-03-22
Time: 16:30-17:30
Abstract:

A review of clinical applications of Monte Carlo with examples from my own clinical practice along with an in-depth quarter hour on recent benchmarking efforts of EGSnrc and Geant4. That's the A's and B's. We can share a box of See's chocolates during the question period.

Contact: Dave Rogers

Status: CONFIRMED

ANNUAL CAP LECTURE

The Physics of Flight

Viktor Zacek
Universite de Montreal

Location: Steacie 103

Date: 2006-03-24
Time: 14:30-15:30
Abstract:

How do birds, insects and airplanes manage to stay airborne? What is their secret? The mass of a B747 at take off is 300 tons. Therefore in order to get the plane airborne, it needs a downward thrust of at least 3 million Newton. But the only material the airplane can throw down is air! And that's what the wings are for: they deviate a large volume of air downwards. We shall see that the popular explanations of the origin of lift based on Bernoulli's principle are misleading. We will also see that from the hummingbird to the B747, everything that flies obeys the same principles of aerodynamics and physics. We shall talk about the remarkable performances of birds and discuss the limits and constraints, which aircraft designers encounter.

Note: Undergraduate students are especially urged to attend!

Status: CONFIRMED

Elusive Particles: Neutrinos to Dark Matter

Kevin Graham
Queen's University

Location: Herzberg 4351

Date: 2006-03-27
Time: 13:15-14:15
Abstract:

During the last 10 years, increasing focus has been placed on the detection of particles such as neutrinos and WIMPs that, owing to the small interaction cross-sections, large backgrounds, and low energies involved, are elusive and most challenging to detect. None-the-less, some of the most interesting open questions in physics can only be addressed through measurements of these particles, and many efforts are underway to develop the next generation of detectors.

In the first part of the talk, I will review of the current state of our knowledge of neutrinos and outline remaining unanswered questions. The proposed liquid scintillator experiment, SNO+. will be described with emphasis placed on the physics accessible from precise measurements of low-energy solar neutrinos and of geo-neutrinos produced in the Earth.

The question of dark matter will be addressed in the second part of the talk. Direct detection of dark matter particles would be one of the most important discoveries in modern physics. The long-term goal of the DEAP experiment, a liquid argon scintillation detector, is to have sensitivity to the dark matter WIMP-nucleon cross-section down to 10^-46 cm^2. The status of phase I of the DEAP experiment, a 10 kg prototype, will be described along with details of the detection mechanism and background discrimination involved.

Contact: Paul Johns

Status: CONFIRMED

A Snapshot of Hadron Spectroscopy

Jonathan L. Rosner
Enrico Fermi Institute, University of Chicago

Location: Herzberg 4351

Date: 2006-04-04
Time: 15:30-16:30
Abstract:

New results on the spectra of hadrons (strongly interacting particles) have been appearing in abundance in the past few years as a result of improved experimental techniques. These include information on states made of both light quarks (u, d, and s) and with one or more heavy quarks (c, b).

I will present a review of this work with particular emphasis on c c-bar and b b-bar bound states. A number of new results have been found by the CLEO Collaboration at Cornell, with which I have been working for the past three years.

Contact: David Asner

Status: CONFIRMED

Little Higgs Model with T Parity

Maxim Perelstein
Cornell University

Location: Herzberg 4351

Date: 2006-04-18
Time: 15:30-16:30
Abstract:

Little Higgs models provide an interesting alternative description of electroweak symmetry breaking. These models contain a composite Higgs boson and remain perturbative until a scale of order 10 TeV, as preferred by precision electroweak data. Electroweak symmetry breaking is triggered by radiative effects, dominated by the top loop contribution to the Higgs potential. The Littlest Higgs model is a simple and economical implementation of this idea. While the original Littlest Higgs model is disfavored by precision electroweak data, the version of the model which incorporates T-parity (analogous to the R-parity of the MSSM) provides an acceptable fit to data without fine-tuning. This model contains a rich spectrum of new particles at the TeV scale, which are expected to be accessible at the LHC. It also generically contains an attractive dark matter candidate, the T-odd partner of the familiar photon. In this talk, I will review the model and discuss the present experimental constraints as well as the potential signatures at the LHC, the ILC and in dark matter searches.

Contact: Heather Logan

Status: CONFIRMED

Rare decays of the eta meson

Zisis Papandreou
University of Regina

Location: Herzberg 4351

Date: 2006-04-19
Time: 16:45-17:45
Abstract:

A study of several rare eta decays near threshold was carried out at the C-6 (pi-minus) beamline of the Alternating Gradient Synchrotron at Brookhaven National Laboratory with the Crystal Ball detector, an electromagnetic calorimeter with nearly 4pi geometric acceptance that is comprised of 672 optically isolated NaI(Tl) crystals with a thickness of 15.7 radiation lengths.

Results from the search for the CP forbidden decay eta -> 4 pi0 and the investigation of the quadratic slope parameter in eta -> 3 pi0 decay will be profiled, among others. The focus of the talk will be on the eta -> pi0 gamma gamma rare decay: its relative branching ratio was extracted to be B1 = (8.3 +- 2.8 +- 1.2) x 10^-4, based on the analysis of 3 x 10^7 detected eta mesons. This leads to a partial width for the eta meson of Gamma(eta -> pi0 gamma gamma) = (0.32 +- 0.15) eV/c^2, a value much lower than past measurements and in line with Chiral Perturbation Theory calculations and recent measurements.

Contact: Alain Bellerive

Status: CONFIRMED

Quest for neutrino-less double beta decay -- Is there a better way?

Dave Nygren
Lawrence Berkeley National Lab

Location: Herzberg 4351

Date: 2006-05-29
Time: 10:30-11:30
Abstract:

After more than 70 years since the possibility was recognized, nuclear double beta decay remains a central topic in nuclear and particle physics. The discovery of neutrino oscillations implies a non-zero neutrino mass, one of the conditions for neutrino-less double beta decay. A convincing observation of this decay would mean that the neutrino is its own anti-particle, unique among fermions, and that lepton number is not conserved. A new concept in the search for

neutrino-less double beta decay is described, aimed at simultaneous realization of 3-D event localization, detailed event reconstruction, fully active variable fiducial surfaces, and 1% FWHM energy resolution at the Q-value of 136Xe, the optimum candidate nucleus for this technique. The concept is based on direct detection of ionization in a TPC geometry, and scales naturally to the 1000 kg scale. A new methodology for the identification of the daughter nucleus is also described.

The talk will be directed to people who have an interest in double beta decay.

Contact: Madhu Dixit

Status: CONFIRMED

IceCube: Neutrino astronomy at the south pole with a gigaton of ice

Dave Nygren
Lawrence Berkeley National Lab

Location: Herzberg 4351

Date: 2006-05-30
Time: 15:30-16:30
Abstract:

IceCube is under construction in Antarctica, at the south pole. Building on the experience with AMANDA, also at the south pole, IceCube aims at detecting extraterrestrial neutrinos, searching for point sources, as well as diffuse flux implied by the spectrum of UHE cosmic rays. I will describe the physics goals and the unique challenges of experimental design, construction, and operation in this harsh environment.

Colloquium-style talk: students are encouraged to attend!

Contact: Madhu Dixit

Status: CONFIRMED

Presentations by summer students

Location: Herzberg 4351

Date: 2006-08-24
Time: 14:00-16:00
Abstract:

Presentations by NSERC USRA students (20 min each):

Michael Sitwell, Wayne Bonnet, Andrew Droll

Status: CONFIRMED