

## Past Physics Seminar Calendar: 1996-1997

### **Dr. Tao Han (UC Davis) : Strongly Interacting Electro-Weak Sector**

Monday, September 9, 1996

Location: HP 4351

Time: 3:30 pm

One of the most prominent questions in contemporary particle physics is the mechanism of the electroweak symmetry breaking. If there are no Higgs bosons found in the next generation of collider experiments, the electroweak symmetry breaking sector will become strongly interacting at high energies. We discuss the physics implication of such a sector and the experimental signatures at future colliders in a model-independent way.

Contact Person: Steve Godfrey

---

### **Dr. Pratibha Vikas (U of Montreal) : A Review of B hadron lifetimes and time dependent B mixing at LEP**

Friday, September 13, 1996

Location: HP 4351

Time: 11:00 am

Measurement techniques and results of average and individual B hadron lifetimes and time dependent B mixing at LEP will be reviewed.

Contact Person: Richard Hemingway

---

### **Dr. Pauline Gagnon (CRPP) : Semileptonic branching ratio for b baryons**

Monday, September 16, 1996

Location: HP 4351

Time: 3:30 pm

A large difference has been observed between b baryons and B meson lifetimes. One could then expect the semileptonic branching ratio of b baryons to be quite different from B mesons. Some ambiguity has also emerged in the experimental data in the measurement of the semileptonic branching ratio for B mesons. A measurement of the semileptonic branching ratio for the b baryons could shed some light by inferring or confirming the trend observed with the lifetimes. There are no theoretical predictions nor experimental measurements for the semileptonic branching ratio for the b baryons yet. Multihadronic events collected with the OPAL detector between 1991-94 are used for this measurement.

This talk is intended for general physics audience and not the selected few experts. I fully intend to avoid jargon and to make it comprehensible for all graduate students and faculty. My intention is to stress the most interesting points of the method used to extract this measurement and hopefully, not the audience. Everybody is welcome.

Contact Person: Hans Mes

---

## **Dr. Mark Samuel (Oklahoma State) : Going to higher orders in Field Theory and Statistical Physics - the hard way and the easy way, the agony and the ecstasy**

Friday, September 20, 1996

Location: HP 4351

Time: 11:00 am

AN INTRODUCTION TO SERIES WILL BE GIVEN. SERIES ARISE IN A WIDE CLASS OF CALCULATIONS IN MATHEMATICS, STATISTICAL PHYSICS, CONDENSED MATTER AND PERTURBATIVE QUANTUM FIELD THEORY. A METHOD FOR ESTIMATING HIGHER-ORDER CONTRIBUTIONS, AS WELL AS THE SUM OF THE SERIES WILL BE PRESENTED. THE METHOD MAKES USE OF PADE APPROXIMANTS (PA). AN INTRODUCTION TO PA WILL BE GIVEN.

Contact Person: M. Sundaresan

---

## **OCIP Seminar: Dr. V.Elagupillai (AECB) : Chernobyl Nuclear Accident: What Really Happened at Chernobyl on that Fateful Night of April 25, 1986; Health Consequences 10 Years Later.**

Monday, September 30, 1996

Location: HP 4351

Time: 3:30 pm

In this seminar, the events which lead to the fateful nuclear accident at Unit 4 of the Chernobyl nuclear reactors will be reviewed. The sequence explosions and the influence of the then prevailing atmospheric conditions on the dispersion of radioactive substances over Ukraine, Belaurus, the Russian Federation and Eastern Europe will be discussed. Radiation doses resulting from these exposures, and the uncertainties associated with the dose estimates will be presented. Observed health effects, mainly acute radiation syndrome and the incidence of thyroid and other cancers among exposed children, liquidators(clean-up crew) and the persons lived in contaminated areas will be reviewed. Impact of the findings of the "Chernobyl Effects" on the overall understanding of the health effects of ionising radiation and, in particular, on the validity of the rational used in the establishment of the current regulatory dose limits will be discussed. The uniqueness of the "Chernobyl Cohort" for further research on health effects of radiation exposure and on the mechanism of the induction of radiogenic cancer will be examined.

Contact Person: Giles Santyr

---

## **Dr. Graham Wilson (DESY, Hamburg) : Highlights of the first physics at LEP2**

Wednesday, October 2, 1996

Location: HP 4351

Time: 3:30 pm

The LEP accelerator has recently been upgraded in energy to surpass the threshold for  $W+W^-$  pair production. The OPAL experiment has produced first physics results on (a) Higgs and 4-jet searches (b)  $W+W^-$  production (c) 2-fermion and 4-fermion Standard Model processes (d) hadronic events and (e) searches for new physics (eg supersymmetry). Several of these topics will be discussed, time permitting.

Contact Person: Richard Hemingway

---

## **Dr. Tony Noble (CRPP, Carleton) : Solar neutrinos and the status of SNO**

Monday, October 7, 1996

Location: HP 4351

Time: 3:30 pm

The Sudbury Neutrino Observatory is currently under construction 2 Km underground at the bottom of the Creighton Mine in Sudbury. This experiment has a uniquely Canadian flavour, as it takes advantage of the worlds largest reserves of heavy water, and the depth of the Creighton mine. It will begin data taking in 1997. The use of heavy water allows both the total neutrino flux and the electron neutrino flux to be measured, and hence it will determine whether the solar neutrino problem is due to neutrino oscillations. The potential physics impact of SNO and its current status will be discussed.

Contact Person: Richard Hemingway

---

## **Special Seminar: Dr. Lawrence Krauss (Case Western Reserve Univ) : The Physics of Star Trek**

Wednesday, October 23, 1996

Location: Bell Theatre, Minto Centre

Time: 8:00 pm

Contact Person: Steve Godfrey

---

## **Dr. Lawrence Krauss (Case Western Reserve Univ) : Life, the Universe and Nothing: The case for a cosmological constant ....**

Thursday, October 24, 1996

Location: HP 4351

Time: 9:30 am

Contact Person: Steve Godfrey

---

## **OCIP Seminar: Dr. Alan Slavin (Trent) : Teaching Introductory Physics**

Friday, October 25, 1996

Location: University of Ottawa

Time: 2:30 pm

Our students inhabit a globe faced with rapidly changing technology, uncertain employment prospects, serious environmental problems, and enormous disparity in living conditions between rich and poor countries -- and they know it.

Luckily, many of the skills they need to be successful in physics are also those which will equip them well for the world ahead: good analytical and communication skills, the ability to work with others, and a sense of their discipline and their place in time. This talk will discuss a range of approaches for developing skills useful to the student (including ability with physics). They include, for example, cooperative learning techniques, an essay on the history and philosophy of physics, and the use of logic flow diagrams in problem solving.

Contact Person: Ivan L'Heureux

---

## **Dr. Ivan Melo (Carleton) : THE PHENOMENOLOGY OF NEUTRAL HEAVY LEPTONS**

Monday, October 28, 1996

Location: HP 4351

Time: 3:30 pm

Experimental limits tell us that the neutrino mass in a given family is much smaller than the masses of other family members. This poses a problem for theory: why this anomaly ? Popular solutions typically require the existence of neutral heavy leptons (NHL's). These new fermions modify the standard weak interactions by mixing with ordinary neutrinos. I will discuss the low-energy phenomenology of NHL's and show what limits on the mass and the mixings of NHL's can be derived from the studies of tree-level and one-loop corrections due to their presence in weak processes.

Contact Person: Richard Hemingway

---

## **Dr. Benoit Simard (NRC) : Nuclear hyperpolarization of rare gases: fundamentals and applications.**

Monday, November 4, 1996

Location: HP 4351

Time: 3:30 pm

The current techniques to synthesize hyperpolarized rare gases will be reviewed and discussed. The usefulness of hyperpolarized rare gases in chemistry, medicine and physics will be demonstrated by recent published work by various groups.

Contact Person: Giles Santyr

---

## **OCIP Seminar: Dr. Ralph Roskies (Pittsburgh) : High Performance Computing, the Scientific Imperative**

Monday, November 11, 1996

Location: HP 4351

Time: 3:30 pm

Simulation using high performance computing has become a powerful scientific tool, with the highest end computing driving the development of new Science. Simulation changes the way we do Science because it is often faster, cheaper, safer, and more thorough than experiment. High performance computing changes the kinds of problems people attack. I

will illustrate how each new generation of machine has enabled breakthrough work. I will then examine future trends in high performance computing.

Contact Person: Lazer Resnick

---

## **Dr. Jules Gascon (Montreal) : JET PHYSICS, what we have learned at LEP1 and how we use it at LEP2**

Friday, November 15, 1996

Location: HP 4351

Time: 2:30 pm

Contact Person: Bob Carnegie

---

## **Dr. Robert McPherson (CERN) : Hunting for new (and barely used) particles at LEP2**

Tuesday, November 19, 1996

Location: HP 4351

Time: 3:30 pm

Contact Person: Bob Carnegie

---

## **Dr. Richard Cobbold (Toronto) : DOPPLER ULTRASOUND, Some Insights from a Historical Perspective**

Monday, November 25, 1996

Location: HP 4351

Time: 3:30 pm

Doppler ultrasound diagnostic methods for the non-invasive measurement of blood flow and its velocity distribution have evolved rapidly over the past ten years. Of particular clinical importance have been the development of color Doppler methods for visualizing spatial flow velocity patterns in real time. Accompanying this has been an improved understanding of the fundamental aspects that limit their performance. In tracing the development and examining the limitations, insights into possible future advances are revealed. Ongoing work into the use of ultrasound for flow measurement of CSF flow in shunts, and studying blood aggregation will also be described.

Contact Person: Giles Santyr

---

## **Dr. Jacques Dubeau (Carleton) : Health Physics Applications of Microstrip Gas Counters**

Monday, December 2, 1996

Location: HP 4351

Time: 3:30 pm

Microstrip gas counters (MSGC) were developed for particle tracking in high energy physics experiments. They are multi-element gas proportional counters with small (200 to 400 micron) spacing between adjacent anodes. These consist of metal strips deposited on a near insulating substrate. Our group is investigating the many possible health physics applications of this technology but photon and neutron microdosimetry is the focus of this presentation. Each anode is sampling a small parallelepiped volume of gas and our calculations on such a shape show that the chord length distribution displays a sharp peak near the value of the anode to anode pitch. In addition the variance of the mean chord length can be kept small through a judicious choice of the other detector dimensions. Hence, a MSGC used in this mode and containing a TE gas mixture will allow the precise definition of a simulated tissue dimension per anode as small as 0.2 micron. This could extend the dosimetry down to low energy neutrons. First results of the operation of an MSGC with TE gas at various pressures and dose distribution spectra under various irradiation fields will be presented.

Contact Person: Richard Hemingway

---

## **Dr. George Redlinger (TRIUMF) : 'Gold-plated' and other rare decays from BNL E-787**

Tuesday, December 3, 1996

Location: HP 4351

Time: 2:00 pm

Contact Person: Bob Carnegie

---

## **Dr. Andre Turcot (Chicago) : 'What's new from OPAL?' Results at $\sqrt{s} = 161$ GeV**

Wednesday, December 11, 1996

Location: HP 4351

Time: 3:30 pm

In the July of 1996, the LEP experimental program entered a new phase when the center-of-mass energy was upgraded to 161 GeV and the pair production of W bosons become kinematically possible. In this seminar, the preliminary results from the OPAL experiment for the recent run at  $\sqrt{s} = 161$  GeV are presented. These results, based on approximately  $10 \text{ pb}^{-1}$  integrated luminosity, include measurements of 2-fermion cross sections and their asymmetries, studies of multihadronic event properties and searches for rare processes and new particles. The measurement W boson properties at threshold is described and results on the W mass, limits on anomalous couplings are presented. The recent run at 172 GeV center-of-mass energy is summarized.

Contact Person: Bob Carnegie

---

## **Dr. Susan Gascon-Shotkin (Maryland) : SEARCHES AT LEP2 WITH THE OPAL EXPERIMENT: STANDARD MODEL HIGGS AND NEW MASSIVE PARTICLES IN THE 4-JET TOPOLOGY**

Monday, January 6, 1997

Location: HP 4351

Time: 3:30 pm

The OPAL experiment has recently entered the LEP2 era, with the recording of 10pb-1 of data at each of  $\sqrt{s}=161$  and 172 GeV. Using the data collected at  $\sqrt{s}=161$  GeV, we have been able to push the mass limit for the Standard Model-predicted Higgs boson upwards to 65.0 GeV. In addition, prompted by the observation by another LEP experiment of an excess of 4-jet events with a peak in dijet masses at  $\sim 105$  GeV, we have searched for a similar effect in the data collected at  $\sqrt{s}=161$  and 172 GeV, as well as in that collected last year at  $\sqrt{s}=130-136$  GeV.

Contact Person: Richard Hemingway

---

## **Dr. Gerald Oakham (CRPP) : The Canadian contribution to ATLAS**

Monday, January 20, 1997

Location: HP 4351

Time: 3:30 pm

The Large Hadron Collider (LHC) at CERN will be the premier discovery instrument for particle physics in the first decade of the 21st century. The LHC will produce collisions between protons that will have ten times the energy and 100 times the luminosity of existing devices. This research is expected to shed light on a number of fundamental questions in particle physics such as the mechanism by which sub-atomic particles acquire mass. Seven Canadian groups from across Canada are participating in one of the experiments at the LHC, ATLAS. The ATLAS collaboration is designing a large general purpose detector, 26m long, 20m in diameter and weighing 7000 tonnes. The Canadian groups are proposing to make a contribution to the Liquid Argon calorimeters for this detector. The seminar will describe ATLAS and focus on the Canadian contribution to the experiment.

Contact Person: Richard Hemingway

---

## **Dr. Keith St.Lawrence (Western) : The Measurement of Cerebral Blood Flow using Magnetic Resonance Spectroscopy and the tracer Deuterium Oxide.**

Location: HP 4351

Time: 2:30 pm

Cerebral Blood Flow (CBF), which is vital for maintaining tissue viability, can be measured using magnetic resonance spectroscopy to monitor the clearance of deuterium oxide from brain tissue. To obtain quantitative measurements of CBF from a specific region in the brain, two important aspects of this measuring technique were investigated. First, a tracer kinetic model was developed for characterizing the clearance data and this model was tested by measuring CBF in rabbits. Second, a spatial localization technique was developed for determining CBF from a specific site in the brain. Both of these topics will be discussed in this presentation.

Contact Person: Giles Santyr

---

## **APS Seminar: Dr. Janet Sisterson (Harvard) : Proton and Ion Therapy in**

## **1996: The world wide experience**

Monday, February 3, 1997

Location: HP 4351

Time: 3:30 pm

World wide, there are 16 proton therapy centers and one heavy ion facility treating patients for both benign and malignant disease. By July 1 1996, nearly 18,000 patients have been treated with proton beams, more than 2000 patients with heavy ion beams and over 1000 patients with pion beams. Only one of the proton therapy facilities was designed to operate within a hospital setting; most facilities use proton accelerators designed for physics research and adapted for medical use. Techniques used in proton therapy will be illustrated using the 35 year Harvard Cyclotron Laboratory/Massachusetts General Hospital experience. Information on all the operating facilities in the world and the world wide clinical experience in 1994 will be presented.

Contact Person: Giles Santyr

---

## **OCIP Seminar: Dr. Paul Corkum (NRC) : Femtosecond Science: Towards Molecular Photography**

Monday, February 10, 1997

Location: HP 4351

Time: 3:30 pm

Laser pulses are now as short as 4.5 femtoseconds ( $4.5 \times 10^{-15}$  sec) and we anticipate sub- femtosecond pulses soon. In one femtosecond light travels only about 0.2 micron while atoms or molecules are virtually frozen in space. After introducing femtosecond science I will describe experiments in which we use one femtosecond pulse to initiate a chemical reaction and a second (intense) pulse to "photograph" the reaction as it proceeds. To "photograph" the reaction the second pulse removes many electron from the atoms within a molecule. The electron removal occurs so fast that the ions are frozen by their own inertia, exploding after the pulse is over in a "Coulomb explosion" that results from the Coulomb repulsion of the fragments. By measuring the momentum of each fragment we can measure the molecular structure at the time of explosion. Varying the time delay, we can take a "movie" of the molecule as it dissociates.

Contact Person: Richard Hemingway

---

## **Dr. Bruno Madore (Toronto) : Reduced Data Requirements for Phase-Contrast MR Angiography**

Monday, February 17, 1997

Location: HP 4351

Time: 3:30 pm

A class of magnetic resonance angiography (MRA) methods, called time- of-flight (TOF), seems to be preferred over a second class of methods called phase-contrast (PC), even if the latter provides a greater suppression of static tissues surrounding blood vessels. A major reason for the lack of popularity of PC methods is the significantly longer imaging time required in PC angiography. In this presentation, it is recognized that a large portion of the information acquired in PC MRA is either redundant, or simply discarded. This suggests that faster PC methods could be designed if one can avoid acquiring unnecessary information, through the use of more efficient strategies for encoding (and then decoding) velocity information into the MR signal. PC methods having reduced data requirements will be presented; these methods achieve such a reduction by encoding velocity information in both the phase and the magnitude of a voxel, instead of



using only the phase, as in conventional PC MRA. There are degeneracies in the acquisition process, in phase-contrast MR angiography. However, the methods presented here show that these degeneracies are not a fundamental limitation of the phase-contrast approach, since they can be partly eliminated.

Contact Person: Giles Santyr

---

## **Dr. Thomas J. Ruth (UBC/TRIUMF) : From disease prediction to therapy: Positron Emission Tomography in movement disorders.**

Wednesday, February 19, 1997

Location: HP 4351

Time: 3:30 pm

Parkinsons disease is the result of cell death in the substantia nigra. From post mortum studies nearly 80% of the SN cells have been lost before the disease is clinically detected. PET with appropriate tracers has shown preclinical changes. The next challenge is to monitor various therapeutic approaches.

Contact Person: Giles Santyr

---

## **APS Seminar: Dr. Karen Lingel (Cornell) : RECENT B PHYSICS RESULTS FROM CLEO**

Monday, March 3, 1997

Location: HP 4351

Time: 3:30 pm

CLEO II has collected 3.3 million  $B\bar{B}$  events. This large dataset has made possible a number of interesting B analyses. I present several results on searches for rare B decays including observations of  $B^+ \rightarrow \omega h^+$  and  $B^+ \rightarrow \eta' K^+$  and an update on  $B^0 \rightarrow K^+\pi^-$  and  $\pi^+\pi^-$ . CLEO also has new results on additional decays of interest to future B factories: a full angular analysis of  $B \rightarrow \psi K^*$ , and searches for  $B^0 \rightarrow D^{(*)}D^{(*)-}$ . We also continue to develop novel techniques for using our dataset optimally, for example, the "neutrino reconstruction" technique has been applied to  $B \rightarrow D^1 \nu$  decays to extract branching fractions, form factors, and  $V_{cb}$ . I will also briefly show highlights and prospects for CLEO 2.5 and CLEO III.

Contact Person: Richard Hemingway

---

## **CAP Lecture: Dr. John P. Harrison (Queen's) : NORMAL AND SUPERFLUID $^3\text{He}$ - THE ANALOGIES WITH METALS AND SUPERCONDUCTORS**

Monday, March 10, 1997

Location: HP 4351

Time: 3:30 pm

The  $^3\text{He}$  atom, like the electron has an odd number of elementary particles (5 compared to 1). Both are spin-1/2 fermions. At 3 degrees Kelvin,  $^3\text{He}$  condenses into the liquid state; it is a very unusual liquid in that its properties are governed

more by quantum mechanics than classical mechanics, as is also the case of the electron gas in a metal. The quantum mechanics of many-particle systems is sensitive to the spin of the particles and for this reason liquid  $^3\text{He}$  and the electron gas share many properties: heat capacity, magnetic susceptibility, a superfluid state analagous to the superconducting state of a metal. This talk, which will be suitable for a general audience, will draw the parallels between  $^3\text{He}$  and the electron gas, describe the superfluid state below 2.5 mK, and describe our experiments on dissipation in the superfluid state and the discovery of the  $^3\text{He}$  analogue of thermoelectricity.

Contact Person: John Armitage

---

## **Dr. John D'Auria (SFU) : Research with Radioactive Beams at TRIUMF**

Monday, March 17, 1997

Location: HP 4351

Time: 3:30 pm

Radioactive ion beams have been available at TRIUMF and specifically at the thick target, on-line isotope separator, TISOL, for almost 10 years leading to experimental programs in the areas of experimental nuclear astrophysics, nuclear spectroscopy and studies of fundamental interactions using magneto-optical traps. In 1995 funding was received to add a new facility, ISAC, which will combine a new ISOL device along with a booster accelerator to produce intense, low energy, accelerated radioactive beams with  $A/q < 30$  from 0.15 to 1.5 MeV/u. Increased opportunities for studies in nuclear astrophysics, nuclear reactions with radioactive beams, studying the properties of nuclides far from stability, material science, accelerated mass spectroscopy, testing the Standard Model of Weak Interactions, and studies of parity non-conservation in atomic transitions at TISOL and ISAC will be described briefly, along with a status report on the building of ISAC.

Contact Person: Richard Hemingway

---

## **Dr. Sampa Bhadra (York) : Deep Inside the Proton: Results from ZEUS at HERA**

Monday, March 24, 1997

Location: HP 4351

Time: 3:30 pm

HERA is an electron proton collider that allows us to probe the complex structure of the proton to the smallest values of  $x$ , the fractional momentum carried by the struck parton in the proton, and the highest  $Q^2$ , the virtuality of the exchanged photon. In addition, the real photon can also be studied in photoproduced events at HERA at the largest center-of-mass energies available to date. The behaviour of the photon as it changes in virtuality from real to highly virtual will be discussed. Comparisons of experimental data will be made with predictions and parametrizations for the proton and photon structure.

Contact Person: Richard Hemingway

---

## **Dr. Peter Watson (Carleton) : Time and the Bouncing Neutron**

Monday, April 7, 1997

Location: HP 4351

Time: 3:30 pm

It is well known that a non-zero value for the neutron EDM is an indication of T non-conservation. A huge range of predictions come out of a variety of models: the current experimental limit is approx  $10^{-25}$  e cm. This talk will discuss a novel idea for an experiment which could (in principle) improve the limit by several orders of magnitude.

Contact Person: Richard Hemingway

---

## **Dr. Jidong Xu (University of Stuttgart) : Gas Phase Magnetic Resonance**

Friday, May 9, 1997

Location: HP 4351

Time: 10:00 am

Gas phase magnetic resonance is an important branch of magnetic resonance with a lot of techniques and methods. This seminar we will focus on optical magnetic resonance, and discuss the basic ideas and methods of optical pumping and optical detection. Two questions will be addressed: (a) How can the multiple quantum coherence in an alkali atomic gas be measured with multiple dimensional NMR techniques? (b) How can Xenon gas be polarized by optical pumping spin exchange techniques ?

Contact Person: Giles Santyr

---

## **Dr. George Gaikos (Akron) : Hybrid Detection Trends in Medical Imaging**

Thursday, May 22, 1997

Location: HP 4351

Time: 3:30 pm

Intensive efforts are in progress to develop new methods of radiographic imaging that utilize electronics and computer technology with the aim to improve diagnostic quality parameters and to evolve new diagnostic modalities with reduced patient dose.

Engineering criteria for the design of electronic detectors for digital radiography are dictated by criteria aimed at maximizing spatial, temporal, contrast resolution, signal to noise ratio and detective quantum efficiency (DQE), while maintaining sufficient sampling rates.

In this seminar, the physical and engineering principles along with ongoing research on the development of novel electronic detectors, operating on hybrid detection principles, for medical imaging applications, are presented and discussed.

Contact Person: Giles Santyr