

## Past Physics Seminar Calendar: 2001-2002

### **Greg Cron (Carleton Univ.): The use of Magnetic Resonance Imaging and intravenously injected contrast agents to measure blood flow in tumours**

Date: Monday, September 17, 2001

Location: HP 4351

Time: 3:30 pm

Abstract: Angiogenesis, which is the rapid production of dense beds of nutrient-providing capillaries, is an important prognostic in the detection and monitoring of cancer. Dynamic contrast-enhanced Magnetic Resonance Imaging (MRI) may be used to evaluate non-invasively the extent of angiogenesis in-vivo. Through tracer kinetic modeling of the concentration-versus-time of contrast agent in both tumour tissue and arterial blood, parameters related to blood flow and capillary permeability can be extracted. This talk will explain how this is done in practice using MRI. In addition, two applications of this method will be discussed, one of which is the differentiation of malignant from benign breast tumours in humans.

Contact person: Paul Johns

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### **Rob McPherson (University of Victoria and IPP): Higgs and Other Searches at LEP 2000**

Date: Monday, September 24, 2001

Location: HP 4351

Time: 3:30 pm

Abstract: The Standard Model of Particle Physics is a successful but experimentally incomplete theory and the Large Electron Positron Collider, which recently completed data taking, has been a unique facility for probing new physics possibilities. The LEP collaborations have reported an indication of Standard Model Higgs boson production, and this evidence is reviewed.

Contact person: John Armitage

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### **Louis Lessard (Montreal): The PICASSO Project: Towards the Detection of Cold Dark Matter**

Date: Tuesday, October 9, 2001 (NOTE DAY OF THE WEEK)

Location: HP 4351

Time: 3:30 pm

Abstract: Cold dark matter has been shown to consist mainly of non-baryonic particles of which a candidate of choice could be the neutralino of super-symmetry. Present mass limits obtained at LEP and theoretical cross section estimates indicate that the sensitivity of all detection systems being developed must be substantially increased in order to detect such particles in the galactic environment. We have shown, with a system of 20 10-ml superheated droplet detectors, what sensitivity could be obtained with this technique. A new fabrication process is being used which allows the construction of much larger detectors of more than one-litre volume, which represents a factor of 100 gain in sensitivity; 6-litre

detection units are now feasible. We will discuss the gain in sensitivity now within reach, measurements in progress, and what future developments are being envisaged. The emphasis of the presentation will be on the instrumentation and experimental aspects of the project. A realistic timescale for a large and competitive cold dark matter detector will be discussed.

Contact person: David Sinclair

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## **Mike Boyce (Carleton University): Introduction to Particle Physics**

Date: Monday, October 15, 2001

Location: HP 4351

Time: 3:30 pm

Abstract: Ever wonder what the fundamental building blocks of the universe are, but just couldn't find the Rosetta Stone to unlock those mysterious words coming out of particle physicists' mouths? Well then, this talk is for you! Explanations, in layman's terms, are given of the complex processes going on in our Sun. Non-technical terms, such as sticky and heavy photons, are used. The standard model of particle physics and our current understanding of the fundamental laws and particles of which we are composed are covered. The AMANDA, SPASE, RICE, and Vulcan particle astrophysics experiments [1] at the South Pole [2] are discussed at the end, as applications. The speaker was a member of the AMANDA experiment at the Amundsen-Scott Pole Station during the 2000 Antarctic winter. A previous version of the talk, presented at the Pole, is at [3].

[1]. <http://amanda.berkeley.edu/amanda/amanda.html>

[2]. <http://www.spole.gov>

[3]. <http://www.physics.carleton.ca/~boyce/spole/talk/index.htm>

\*\*\* Undergraduate students are especially encouraged to attend \*\*\*

Contact person: Paul Johns

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## **David Wilkins (Ottawa Regional Cancer Centre): Radiobiological Considerations in Prostate Cancer**

Date: Monday, October 29, 2001

Location: HP 4351

Time: 3:30 pm

Abstract: Prostate cancer represents a large and increasing proportion of the workload in most radiation therapy centres. There is recent evidence that the radiation response of prostate cancer is characterized by an alpha/beta ratio much lower than that of most cancers. This suggests that prostate cancer could be treated with a smaller number of daily fractions. The arguments for this will be presented, and some clinical implications will be discussed.

Contact person: Paul Johns

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## **William Bradfield-Smith (Queens University): Exploding stars in the laboratory: A few years in the life of an experimental nuclear physicist**

Date: Monday, November 5, 2001  
Location: HP 4351

Time: 3:30 pm

Contact person: Alain Bellerive

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## **Philippe Leblanc (Centre de Recherches du Centre Hospitalier de l'Universite de Montreal): Endovascular $^{32}\text{P}$ Beta Irradiation using Radioactive Coils to Improve the Treatment of Cerebral Aneurysms?**

Date: Monday, November 19, 2001  
Location: HP 4351

Time: 3:30 pm

Abstract: Endovascular treatment of cerebral aneurysms by embolization using platinum coils - a minimally invasive alternative to surgery - is too often followed by recurrences. In collaboration with the radiology department of Notre-Dame Hospital and the Ion Implantation Group of Universite de Montreal, we have started a research project to study the effect of  $\beta$  irradiation on aneurysm recurrences using radioactive coils produced by ion implantation of  $^{32}\text{P}$ . I will describe the different aspects involved in this project: the medical application, the ion implantation of coils, the dosimetry and the pre-clinical results obtained so far.

Contact person: Paul Johns

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## **Paul Taras (Montreal): CP violation in the B-meson system at BaBar**

Date: Monday, November 26, 2001  
Location: HP 4351

Time: 3:30 pm

Abstract: To a very large extent, our world is made of matter. What then happened to the anti-matter that was created at the same time as matter at the beginning of the Universe? The accepted explanation for this phenomenon requires the violation of an important symmetry in physics, the CP symmetry. According to the Standard Model, a model which is extremely successful in accounting for all observations in particle physics, we should measure a considerable CP violation in the B-meson system. We will indicate how CP violation arises in the context of the Standard Model. Then after a brief description of the PEP-II accelerator and the BaBar detector, used to accumulate the 32 million B B(bar) mesons investigated in the present study, we will present the flavour of the analysis and the most recent results.

Contact person: Alain Bellerive

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**OCIP Fall Graduate Student Seminars**

Date: Monday, December 3, 2001

Location: Carleton University, Senate Chambers, Robertson Hall 6th floor.

Time: 2:00 - 5:00 p.m.

Details are posted at [www.ocip.carleton.ca](http://www.ocip.carleton.ca) under Calendar of Events.

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The Herzberg Lecture - 2001: John Bahcall (Princeton): How Does the Sun Shine?

Date: Tuesday, December 4, 2001

Location: Alumni Theatre.

Time: 8:00 p.m.

Details: <http://www.carleton.ca/science/Herz.html>

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## **OCIP Christmas Symposium**

Date: Tuesday, December 18, 2001

Location: University of Ottawa, Colonel By Hall, room C03.

Time: 9:00 a.m. - 12:30 p.m. Followed by lunch.

Details are posted at [www.ocip.carleton.ca](http://www.ocip.carleton.ca) under Calendar of Events.

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## **Mark Chen (Queen's University): Neutrino Astrophysics with Liquid Scintillators**

Date: Monday, January 7, 2002

Location: HP 4351

Time: 3:30 pm

Abstract: The next frontier in neutrino physics is the direct detection of low-energy solar neutrinos. The next solar neutrino experiment to come online after SNO will be Borexino. Construction of the Borexino detector in the Gran Sasso underground lab in Italy will be completed in 2002; Borexino will soon hold 300 tonnes of liquid scintillator and will observe 0.86 MeV Be-7 solar neutrinos via neutrino-electron scattering. Borexino will measure the total flux and survival probability for Be-7 solar neutrinos. Combining results from Borexino and SNO, a complete picture of neutrinos from the Sun will begin to unfold. Some future possibilities with liquid scintillators, beyond SNO and Borexino, will also be presented.

Contact person: Alain Bellerive

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## **Ronald D. Settles (MPI, Munich): e+e- Linear Collider: Status of Machine/ Physics/Detector Studies**

Date: Monday, January 14, 2002  
Location: HP 4351

Time: 3:30 pm

Abstract: A high energy  $e^+ e^-$  linear collider with energy greater than 0.5 TeV will be needed to complement the physics discoveries of the CERN Large Hadron Collider. The future  $e^+ e^-$  linear collider will also provide unique opportunities in precision electroweak, top and Higgs physics as well as a probe of new physics at the TeV scale. Significant international efforts, needed to design and build the future  $e^+ e^-$  linear collider machine and the detector for physics, are well under way in Europe, in the US and in Japan. An overview of the R&D challenges and the status of the linear collider machine, physics and the detector studies will be described in the context of TESLA proposal in Europe that was submitted to German Government in March, 2001.

Contact person: Madhu Dixit

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## **Grant Nixon (MDS Nordion): A Survey of Applied Radiation Physics at MDS Nordion**

Date: Monday, January 21, 2002  
Location: HP 4351

Time: 3:30 pm

Abstract: MDS Nordion is part of MDS Inc., an international health and life sciences company. We specialize in radioisotopes, radiation, and related technologies used to diagnose, prevent and treat disease. MDS Nordion is comprised of 3 major business units. Nuclear Medicine supplies major radiopharmaceutical producers, hospitals and clinics around the world. Therapy Systems provides clinical solutions for managing and delivering cancer care. Ion Technologies designs, builds and supports commercial irradiators used for, among other things, sterilizing medical supplies and reducing harmful microorganisms in food products. We are also the world's leading supplier of cobalt-60 gamma sources. This talk will cover some areas where applied radiation physicists play an integral role.

\*\*\* Undergraduate students are especially encouraged to attend \*\*\*

Contact person: Paul Johns

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## **Ranpal Dosanjh (Cambridge): Direct CP violation measurement at NA48**

Date: Monday, January 28, 2002  
Location: HP 4351

Time: 3:30 pm

Abstract: In May 2001, the NA48 experiment at CERN announced a non-zero measurement of the direct CP violation parameter  $Re(\epsilon'/\epsilon)$ , based on the decay rates of neutral kaons into two pions. In this talk I will briefly describe the detector and experimental method, before discussing some important details of the analysis.

Contact person: Alain Bellerive

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## **David London (University of Montreal): CP Violation in the B System: Present and Future**

Date: Monday, February 11, 2002

Location: HP 4351

Time: 3:30 pm

Abstract: CP violation is one of the most intriguing problems in particle physics, and has important consequences for cosmology. In the summer of 2001, the B-factories BaBar and Belle presented the first definitive evidence for CP violation outside the kaon system. In this talk, after a brief review of CP violation in kaon decays, I will describe the theory of CP violation in B decays within the standard model. I will show how the BaBar/Belle measurements constrain the so-called unitarity triangle. I will conclude with a discussion of future measurements of CP violation in the B system, concentrating on the possibilities for finding new physics.

Contact person: Alain Bellerive

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## **Donald Plewes (University of Toronto): Micro-Scale Motion Imaging with MRI and MRI Elastography**

Date: Monday, February 25, 2002

Location: HP 4351

Time: 3:30 pm

Abstract: The traditional role of Magnetic Resonance Imaging (MRI) is to provide images of stationary soft-tissue anatomy. However, by the use of appropriate pulsed magnetic field gradients and pulse sequences, MRI can also be used to visualize and measure the evolution of three-dimensional motion in time. This has been used to characterize and quantify flow phenomena and detailed hydrodynamic features of cardio-vascular disorders. We have been extended these concepts to other applications whereby very small coherent motions can be resolved in soft tissues. One example uses external mechanical stimulation of tissue to create either DC strain fields or strain waves (~100 Hz) that propagate throughout tissue. From these data, the three dimensional distribution of tissue biomechanical properties can be obtained through appropriate inverse solutions based on the Navier equations. A second application uses RF pulsed gradient waveforms (~1MHz) to visualize the propagation of medical ultrasound (US) fields in tissue. Based on current experimental systems, oscillatory motions with amplitudes as small as 40 Angstroms can be resolved. This concept opens a new approach for the non-invasive study US interactions with tissues and provides a standard for US dosimetry of displacement, power and pressure based only on fundamental constants. In this presentation, we will review the details of these concepts and summarize the current state-of-the-art in their clinical application.

Contact person: Giles Santyr

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## **Randy Lewis (University of Regina) Phenomenology from Lattice QCD**

Date: Monday, March 04, 2002

Location: HP 4351

Time: 3:30 pm

Abstract: Protons and neutrons are known to be composite objects built of quarks and gluons, with the "up" and "down" type quarks playing a special role. What effect does the implicit strange quark have on a proton or neutron? What is the mass spectrum of composite objects that include explicit strange, charm or bottom quarks? How closely does this spectrum resemble the fine and hyperfine structure of a hydrogen atom? The underlying quantum theory is known, and phenomenologists have a rigorous computational method called lattice QCD. This seminar is intended to be a non-technical discussion of how lattice QCD can be used as a tool by phenomenologists. After mentioning some of the famous successes of lattice QCD, we'll focus on the questions stated above with comparisons to quark models, heavy quark symmetry and experimental results where available. Our conclusion will include a long "to do" list of phenomenology that needs to be studied using lattice QCD.

Contact person: Steve Godfrey

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## **Jonathan R. Ellis (CERN): Beyond the Standard Model**

Date: Friday, March 15, 2002

Location: HP 5115

Time: 2:00 pm

Abstract:

Review of Supersymmetry and look at new physics beyond the Standard Model of elementary particles: SUSY, neutrinos, and lepton-flavor violation.

Contact person: Bob Carnegie

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## **Raymond Laflamme (Waterloo): Quantum Computing Carleton CAP Lecture for Undergraduate students**

Date: Monday, March 18, 2002

Location: HP 4351

Time: 3:30 pm

Abstract: Advances in computing are revolutionizing our world. Present day computers advance at a rapid pace toward the barrier defined by the laws of quantum physics. The quantum computation program short-circuits that constraint by exploiting the quantum laws to advantage rather than regarding them as obstacles. Quantum computer accepts any superposition of its inputs as an input, and processes the components simultaneously, performing a sophisticated interference experiment of classical inputs. This "quantum parallelism" allows one to explore exponentially many trial solutions with relatively modest means, and to select the correct one. This has a particularly dramatic effect on factoring of large integers, which is at the core of the present day encryption strategies (public key) used in diplomatic communication, and (increasingly) in business. As demonstrated approximately five years ago, quantum computers could yield the most commonly used encryption protocol obsolete. Since then, it was also realized that quantum computation can lead to breakthroughs elsewhere, including simulations of quantum systems, implementation of novel encryption strategies (quantum cryptography), as well as more mundane applications such as sorting. I will describe recent work done in quantum computation, in particular the discovery and implementation of methods to make quantum information robust against corruption, both in theory and experiments. I will end with speculations about the field.

Contact person: Alain Bellerive

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## **Lothar Lilge (Toronto): Biophotonics for biotechnology**

Date: Monday, March 25, 2002

Location: HP 4351

Time: 3:30 pm

### **Abstract:**

Biophotonics is an accepted enabling technology for various applications in medical diagnostics and therapeutics. Laser and light can be used to elicit very selective therapeutic or diagnostic effects in vivo, on the organism, tissue, cell or macromolecular level. Specifically, as the selective power of light interacting with cells and bio molecules was demonstrated, it is somewhat surprising that Biophotonics, as enabling technology, is not thought of or considered during the design and planning phase of programs and projects in Biotechnology. Especially, as in the majority of diagnostic scenarios optical information readout is involved, and specifically for the case of in vivo biotechnology applications patient monitoring should be accomplished optically. This presentation will review laser and light interaction with tissues and biological substrates, demonstrate the current breath of Biophotonics applications in the genomic age and critically reviews the ability of biophotonics to assist or lead the post genomic (proteomic) age.

Contact person: BJ Jarosz

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## **Prof. Albrecht Wagner, University of Hamburg (Director of DESY): TESLA**

Date: Tuesday, May 21, 2002

Location: NRC 100 Sussex Drive Room 3001

Time: 11:00 am

### **Abstract:**

The international TESLA collaboration has presented a proposal to build an electron-positron Linear Collider of 500 GeV centre-of-mass energy with an integrated X-ray Free Electron Laser. The proposal is based on a breakthrough in superconducting accelerator technology. This facility will open unique research possibilities in particle physics as well as in structural research (e.g. material science and biology) with high intensity X-ray lasers. The talk will provide a review of the broad spectrum of science which will become accessible with such a facility and of the technological challenges which have already been mastered. In the framework of the TESLA Test Facility at DESY a new generation of radiation sources for VUV radiation at wavelengths in the 100 nm range has recently become available, exceeding the peak brilliance of previous sources by several orders of magnitude.

Contact person: Dean Karlen