Past Physics Seminar Calendar: 1997-1998

Neil R. S. Simons(Communications Research Center, Ottawa) : Computational Electromagnetics at the Communications Research Centre

Monday, September 8, 1997
Location: HP 4351
Time: 3:30 pm

An overview of computational electromagnetics research topics being addressed at the communications research centre will be provided. The first topic is the development and application of an AutoCAD based EM environment simulator which computes the electromagnetic field in the vicinity of typical ship-borne antenna environments. This tool uses both a free space model of various antennas and a ray-tracing algorithm in conjunction with the Uniform Theory of Diffraction engine. The second topic is the solution of the time-dependent form of Maxwell's equations in three-dimensions using numerical methods such as the transmission line matrix, finite difference, and finite volume methods. Applications related to the analysis of microwave antennas and circuits will be provided. The final topic presented is the development of lattice gas automata for computational electromagnetics. Lattice gas automata are simple computational models which operate on a discrete spatial lattice, evolve in discrete time, and employ simple discrete variables. We have developed a lattice gas automaton which utilizes binary variables to solve the three-dimensional Maxwell's equations. Other developments include the use of small integers variables (of up to 4 bits) rather than binary variables to reduce numerical viscosity. The results of simulations performed using a special purpose computer, the CAM-8 cellular automata machine will be presented.

Contact Person: Steve Godfrey

Joanne Treurniet (Carleton) : Lattice Gases for Electromagnetics

Monday, September 8, 1997
Location: HP 4351
Time: 4:00 pm

Integer lattice gas methods are gaining in popularity due to their speed and inherent lack of computational error. In this study, we attempt to apply these advantages to electromagnetic problems. This talk will provide an introduction to lattice gas automata and transmission line matrix methods, then show how the two can be combined to simulate electromagnetic wave behaviour. Application of the model to the TE modes of a 2-dimensional waveguide will be presented and limitations of the model will be discussed.

This talk is in partial fulfillment of the requirements for course 75.595 and the OCIP graduate student seminar.

Contact Person: Steve Godfrey

Dr. Walter Huda (Syracuse) : COMPUTED RADIOGRAPHY: PRESENT & FUTURE

Monday, September 15, 1997
Location: HP 4351
Time: 3:30 pm

Computed Radiography (CR) uses photostimulable phosphors as a replacement to screen-film systems for performing conventional radiographic examinations. CR is an inherently digital technology which offers consistent image quality as well as the promise of image enhancement which will improve patient diagnostic performance. In addition, the availability of digital images facilitates (digital) image storage as well as rapid image transfer to remote locations (i.e. teleradiology) and thereby has the potential to contribute to a film less radiology department. This talk will review the current status of CR technology, assess its potential for performing future radiographic examinations and discuss the role of CR in Picture Archival and Communications Systems (PACS).

Contact Person: Giles Santyr

Dr. R. Morrison (Carleton) : What to do with Nuclear Weapons Material?

Monday, September 22, 1997
Location: HP 4351
Time: 3:30 pm

The end of the Cold War has led to the dismantling of thousands of nuclear weapons, raising the non-trivial issue of what to do with the resulting weapons grade material. This talk will discuss the emerging stocks of weapons-grade plutonium and highly enriched uranium and some of the technical and political problems in disposing of the material. The emphasis will be on using it as fuel in the civilian nuclear fuel cycle either as low enriched uranium or as mixed-oxide fuel (MOX).

Contact Person: Richard Hemingway

Dr. D. Basu (Carleton) : VOIDS IN THE LARGE SCALE STRUCTURE OF THE UNIVERSE

Monday, September 29, 1997
Location: HP 4351
Time: 3:30 pm

General properties and characteristics of voids in the large scale structure of the universe will first be discussed. Results of some statistical analyses performed on an updated catalogue of voids will be presented showing that the distribution of voids is fairly homogeneous and isotropic, the most frequent size of voids is 10 Mpc and the size of voids is related to distance in the sense that larger voids are located at greater distances. A dendrogram analysis shows that voids exhibit clustering, with a characteristic scale of 59 Mpc. The trend is more dominant in the Northern Hemisphere where data are more complete. Southern Hemisphere data also show clustering effect but rather weakly, possibly due to limited data. Results of the dendrogram analysis are corroborated by checking the void distribution against a Poisson distribution amd also by a two-point correlation function among the voids. However, these findings do not correspond to the standard Cold Dark Matter scenario. Nevertheless, it is suggested that the seeds from which voids are formed may have originated with a biased distribution.

Contact Person: Richard Hemingway

Dr. Gary Slater (UofO) : GENETICS, PHYSICS, AND THE HUMAN GENOME PROJECT

Monday, October 20, 1997

Location: HP 4351
Time: 3:30 pm

The Human Genome Project is possibly the most ambitious multidisciplinary and international scientific project ever. Over the next decades, scientists will read our entire genetic code in order to understand how we function and who we REALLY are. The project is very challenging and requires the competence of scientists from all disciplines. In this talk, I will provide a brief outline of the Genome Project, and the role that both physics and technology will have to play in order to complete this massive undertaking. As an example, I will present some of the theoretical, computational, and experimental work currently in progress in our group. Finally, I will discuss the next logical step of this journey into the secrets of life: understanding protein folding and activity.

Contact Person: Richard Hemingway

Dr. Richard Richardson (AECL) : Fusion, Tritium and the Dosimetry of Tritiated Particulates

Monday, October 27, 1997
Location: HP 4351
Time: 3:30 pm

A problem of concern to fusion and other tritium handling facilities is the production of tritiated aerosols during normal operations and decommissioning. Tritium is a radioactive isotope of hydrogen, with a 12.3 year half-life. The major source of tritium in nature is from nuclear reactions in the upper atmosphere by cosmic rays. The presence and production of tritium, in manmade sources, will be described for laser and tokamak fusion reactors. The radiation protection hazards of tritiated water and tritium gas are relatively well known. The dosimetry of tritiated respirable dusts is not so well understood and this is the subject of our research. We employed Monte Carlo methods to evaluate the energy deposition in a lung model representing tritiated dust on the wall of alveolar sacs. Account was taken of the self-absorption of the low energy beta radiation within the particulates and the clearance of the particulates from the lung.

Contact Person: Giles Santyr

Dr. Madhu Dixit (CRPP) : Digital Radiography using the Gas Microstrip Detector

Monday, November 3, 1997
Location: HP 4351
Time: 3:30 pm

Photographic film/scintillator screen, the present day standard for x-ray imaging, has significant shortcomings. The film/screen has limited dynamic range and once exposed, the details are lost in areas of over- and under-exposure for ever. As well, film grain noise obscures image details at high spatial frequencies. Although, the digital radiography systems currently under development overcome many of these limitations, they all operate in x-ray energy integration mode. The gas microstrip detector (GMD) has the potential to become a unique and powerful new instrument for digital radiography because of its ability to measure the position and the energy of individual x-ray photons at radiological counting rates. The GMD imager will have a dynamic range limited only by the statistics of photon counts, a detective quantum efficiency equal to the quantum efficiency of the detector and the ability to enhance the image using measured x-ray energy. Progress in this medical physics/particle physics new area of research at Carleton/CRPP will be reported.

Contact Person: Richard Hemingway

Dr. Alain Bellerive (McGill) : Investigation of Semileptonic B Meson Decays to P-Wave Charm Mesons

Monday, November 10, 1997
Location: HP 4351
Time: 3:30 pm

The CLEO II detector is a multipurpose high energy physics detector incorporating excellent charged and neutral particle detection and measurement. It has logged to date the largest sample of B mesons in the world using data collected at the Upsilon(4S) resonance. In the present analysis, we study exclusive semileptonic B meson decays with D* pi in the final state. Evidence for exclusive semileptonic production of P-wave charmed mesons and measurements of branching fractions are reported. These decays reveal useful information on the effective couplings of the W boson to heavy quark mesons and on the deficit in inclusive charmed semileptonic B decay.

Contact Person: Richard Hemingway

Dr. Richard J. Hemingway (Carleton) : Selected Topics in Hadron Production in e+e- Collisions

Monday, November 17, 1997
Location: HP 4351
Time: 3:30 pm

This mini-review will focus on selected topics in hadron production as seen in e+e- collisions. Following an introduction to aspects of inclusive hadron production at both the Z peak and at LEP2 energies, a decription will be provided of the following topics in hadronisation: flavour separation, leading particle effects, quark-gluon differences, spin effects, and correlations in the di-baryon system. The talk will end with a brief comparison of how well the two leading MonteCarlo programs actually represent the data.

Contact Person: Richard Hemingway

Dr. Peter Munro (UWO) : Technologies for Identifying Geometric Errors in Radiation Therapy

Monday, November 24, 1997
Location: HP 4351
Time: 3:30 pm

Verification of patient positioning has always been an important aspect of external beam radiation therapy. Over the past decade many devices known as electronic portal imaging devices (EPID's) have been developed to form "portal" images of the patients while they are being treated with the high energy radiation beam. The general approach is to register the anatomic structures in a portal image with the same structures in a simulator film - a film that has been acquired at kilovoltage energies. Once the anatomic structures have been registered, any discrepancies in the position of the patient can be identified.

This presentation will discuss the characteristics and physical performance of various EPID's, describe some of the image

registration techniques, discuss clinical use of EPID's and describe some of the newer technologies that are being developed for improving geometric accuracy of radiation therapy.

Contact Person: Giles Santyr

Dr. Archana Sharma (GSI, Darmstadt) : Recent developments in gas detectors for tracking at high luminosities

Monday, December 1, 1997
Location: HP 4351
Time: 3:30 pm

With the high luminosities of upcoming colliders, the frontiers of present generation gas tracking detectors have been pushed, resulting in a large number of innovations in detector design, technology and readout systems of which I will discuss some examples. The Atlas muon detection system despite comprising "simple" proportional counters, has been extensively studied to better understand and optimize their performance inclusive of the front-end electronics. The MicroStrip Gas Chambers have come long way since their introduction, their spin-offs being Micro-Gap Chambers and the MICRODOT chambers which are described. The introduction of a novel device called the Gas Electron Mulitplier, GEM, is being considered by HERA-B for improved reliability. The MICRO-MEsh Gaseous Structure, (MICROMEGAS) which has the advantages of being a robust, highly granular and a high rate capable detector will also be discussed.

Contact Person: Madhu Dixit

Dr. Bruce Campbell (UofA) : Parametric Resonance, Inflaton Decay, and Supersymmetry

Wednesday, December 17, 1997
Location: HP 3269
Time: 12:00 pm

No abstract received

Contact Person: Richard Hemingway

Dr. Don Wiles (Carleton,Chemistry) : Canada's Approach to High-Level Nuclear Waste Disposal

Monday, January 5, 1998
Location: HP 4351
Time: 3:30 pm

A summary will be given of the nature of Canada's nuclear fuel waste and of the criteria established for its safe disposal. A more detailed discussion will be given of the so-called 'Multi-Barrier' strategy for nuclear waste disposal, with emphasis on Canada's technical choices. The fate of various radionuclides through these barriers will be outlined. The nature of the forecasting calculations will be outlined, and the calculated results will be presented. While the emphasis

will be on the technical aspects, occasional personal views may inadvertedly creep in.

Contact Person: Richard Hemingway

Dr. Cliff Hargrove (CRPP) : Measurement of Neutrino Oscillations and the Pb-neutrino cross section at the RAL ISIS facility

Monday, January 12, 1998
Location: HP 4351
Time: 3:30 pm

The cross section for the interaction with Pb of neutrinos from the beam stop of the RAL ISIS facility is very large. This makes it possible for one to measure this the neutrino-lead cross section with high precision in the same energy region as Supernova neutroinos. It also makes it possible to look for muon-to-electron-neutrino oscillations with sensitivity comparable to that achieved by the LSND experiment in their measurement of antimuon-to-antielectron-neutrino oscillations. I will give an overview of the neutrino oscillation measurement situation, describe the neutrino-lead cross section calculations and the KARMEN experiment at ISIS. Finally, I will describe a prototype experiment using a lead detector at ISIS to measure the cross section and look for neutrino oscillations.

Contact Person: Richard Hemingway

Dr. John Weinstein (Guelph) : THE MULTICHANNEL QUARK MODEL

Monday, January 19, 1998
Location: HP 4351
Time: 3:30 pm

We introduce the standard quark model as a tool for calculating meson spectroscopy based on the underlying quark-gluon interactions. We discuss the strengths and limitations of the model and then show how embedding it in a multichannel formulation resolves some of these limitations and greatly increases it's viability and predictive abilities.

Contact Person: Richard Hemingway

Dr. Catherine Kallin (McMaster) : Antiferromagnetism and Superconductivity in the High Tc Cuprates

Monday, January 26, 1998
Location: HP 4351
Time: 3:30 pm

Zhang* has recently proposed a theory which provides an elegant framework for understanding the interplay of antiferromagnetism and d-wave superconductivity in the high temperature superconducting cuprates. It also makes a number of predictions which can be tested experimentally. In this talk, I will give an introduction to Zhang's theory, the so-called SO(5) theory, of superconductivity and will discuss the experimental predictions, focusing on two specific predictions: (1) the occurance of antiferromagnetic vortex cores and (2) the possibility of constructing heterostructures, such as superconducting-antiferromagnetic-superconducting (S-A-S) sandwiches, which are predicted to undergo a Freederickxz-like transition, similar to that observed in liquid crystals, as a function of A-layer thickness and of applied

current.

*S.C. Zhang, Science 275, 1089 (1997).

Contact Person: Richard Hemingway

Dr. Randy Sobie (Victoria) : TAU PHYSICS AT LEP

Monday, February 2, 1998
Location: HP 4351
Time: 3:30 pm

The large samples of taus at LEP have significantly improved our understanding of this heavy lepton. Tau decays are an excellent laboratory for testing the electroweak interaction as well as the strong interaction. We will discuss some of these measurements and show that tau decays can be used to search for evidence of new physics.

Contact Person: Richard Hemingway

Dr. Ken Ragan (McGill) : Gamma Ray Astrophysics at the CAT

Monday, February 9, 1998
Location: HP 4351
Time: 3:30 pm

Gamma-ray astrophysics has been revolutionized over the last decade by both space-based observation and ground-based results based on the atmospheric Cherenkov technique. We will explain the current situation and some of the more recent results, with particular emphasis on the newest and most sensitive imager: the CAT imaging telescope in the French Pyrenees. We will also briefly mention the next step to higher sensitivity, namely the state of the STACEE and CELESTE solar-array telescope projects.

Contact Person: Richard Hemingway

Dr. Terry Thompson (Western Ontario) : NMR Spectroscopy: No Medical Relevance or New Medical Revolution?

Monday, February 16, 1998
Location: HP 4351
Time: 3:30 pm

MR imaging over the past 15 years has proved its relevance in the medical community. MR spectroscopy has been around longer and to many in the medical community, the technique has not lived up to the advanced billing. Over the past 4 years we have developed in vivo MR spectroscopy, to the point where we believe it is ready to take a leading role in the study of heart attacks and in the diagnosis of certain muscular disorders. We have developed an animal model, which enables MR spectroscopic examination of metabolic changes, which occur during a heart attack. We can follow these changes when various pharmaceutical interventions are undertaken to moderate the ischemia/reperfusion damage. In particular we have shown that beta blockers and free radical scavenger can have a direct effect on tissue metabolism following an ischemic insult. We have also used MR spectroscopy to develop a non-invasive test for Malignant

Hyperthermia - a disorder that can cause susceptible people to have a deadly, adverse reaction to certain anaesthetics. The present "gold standard" for diagnosis is an invasive muscle biopsy, but we have shown that using MR spectroscopy to screen this population, potentially can lead to a reduction in the number of patients requiring the invasive biopsy.

Contact Person: Giles Santyr

Dr. Arnd Leike (Munich) : Phenomenology of Neutral Extra Gauge Bosons

Monday, March 2, 1998
Location: HP 4351
Time: 3:30 pm

The phenomenological constraints on extra neutral gauge bosons at present and at future colliders are reviewed. Special attention is paid to the influence of radiative corrections, systematic errors, and kinematical cuts on the Z' constraints. Simple estimates of the Z' constraints from different reactions are derived. They make the physical origin of these constraints transparent. The results existing in the literature are summarized and compared with the estimates. The consequence of model assumptions on the Z' constraints is discussed. I start with an overview of Z' parameters and the possible links between them by model assumptions. I continue with a discussion of Z' limits and Z' measurements in different reactions at e+e- and mu+mu- colliders. It follows an overview of the corresponding limits at proton colliders. Possible Z' constraints from other reactions as ep collisions, atomic parity violation, neutrino scattering and cosmology are shortly mentioned.

Contact Person: Stephen Godfrey

Dr. John Schreiner (Kingston Regional Cancer Center and Queen's) : Gel Dosimeters for Volumetric Radiation Dosimetry

Monday, March 9, 1998
Location: HP 4351
Time: 3:30 pm

Recently a number of new chemical dosimeters have been developed in the drive for three dimensional volumetric radiation dosimetry with Magnetic Resonance Imaging. These dosimeters are based on gel matrices infused with species that are modified under irradiation. The initial gels were infused with ferrous sulphate and exploited the sensitivity of NMR relaxation times to radiation induced changes in the paramagnetic nature of the iron ions. Newly developed dosimeters are based on the change in molecular dynamics as gels containing monomers cross-link under irradiation. In this presentation, I will review the physical basis for gel dosimetry. The practical utility of the gel dosimeter materials will be illustrated and new developments in their use presented. To close, I will present an overview of some of the areas of MR-dosimetry which are still ripe for study.

Contact Person: Giles Santyr

Dr. Jim Drummond (Toronto) : CAP Colloquium:: The view from space

Monday, March 16, 1998
Location: HP 4351
Time: 3:30 pm

Satellite observations offer a unique view of the entire globe. From simple pictures of the planet to more complex sounders which probe the atmosphere, oceans and surface, the wealth of information available on our world has exploded in the last few years. Physicists have been at the forefront of developing these techniques of remote sounding and remote sensing. Applications range from climate prediction to flood control and ocean productivity to ice flow dynamics. This lecture presents the overview of the subject and "homes in" on some specific Canadian contributions to the field in the areas of high atmosphere measurements, low atmosphere measurements and the surface.

Contact Person: Richard Hemingway

Dr. William Trischuk (Toronto) : B Physics at CDF

Monday, March 23, 1998
Location: HP 4351
Time: 3:30 pm

CDF is well known for its discovery of the top quark and other high p_t physics studies. However, the inclusion of a silicon vertex detector as well as various low p_t lepton and di-lepton triggers has made a rich B physics programme available during the last Tevatron running period.

After a brief review of the run 1 CDF detector configuration and running conditions I will discuss several B physics analyses recently completed. I will review the results that have led to the recent announcement of the discovery of the B_c meson. I will also describe work underway to study CP violation in the B-sector. We have a sample of 250 B to J/Psi K_short decays. Our recently published work on initial state B meson tagging that gives a measurement of B_d mixing also shows how we eventually expect to make a CP measurement on the J/Psi K_short sample.

I will conclude with an overview of the detector upgrades underway for the next running period and give an outlook on the B physics that such a detector and dataset will make possible.

Contact Person: Richard Hemingway

Dr. Vicky Kaspi (MIT) : Neutron Stars Get Their Kicks

Monday, March 30, 1998
Location: HP 4351
Time: 3:30 pm

The very high space velocities of radio pulsars have provided strong circumstantial evidence for birth kicks to neutron stars. Such kicks are thought to be a result of some asymmetry in the formation supernova explosion. However definitive proof of the existence of kicks has been elusive, as models invoking dynamics of disrupted binary systems to explain the pulsar velocity distribution could not be ruled out. In this talk we will present the most direct observational evidence yet for the existence of kicks: the detection of gravitational spin-orbit coupling in the binary radio pulsar PSR J0045-7319.

Contact Person: Richard Hemingway

Dr. Andre Joly (Montreal) : Strange baryon production in e+e- collisions

Tuesday, April 7, 1998

Location: HP 3269 Time:10:30 am

No abstract received

Contact Person: Gerald Oakham

Dr. Howard B. Michaels (Toronto) : Medical Physics Considerations for Stereotactic Radiosurgery and Radiotherapy

Monday, April 27, 1998
Location: HP 4351
Time: 3:30 pm

Stereotactic radiosurgery is a sophisticated technique in radiation therapy in which multiple narrow non-coplanar converging beams of high energy X-rays from a linear accelerator are directed toward a small target volume in the brain localized using a neurosurgical stereotactic frame. At Princess Margaret Hospital, we are using this new technique for single- and multi-fraction treatments for cancer. Special consideration is given to identifying critical normal structures that must be spared, while giving full dose to the tumour. This is accomplished utilizing contrast- enhanced CT and MR scans, and complex three-dimensional image fusion, contouring and beam planning software on a powerful computer workstation. In this presentation, the stereotactic radiotherapy system, including MR to CT image fusion, will be described, with emphasis on geometric and physical considerations in treatment planning for a variety of benign and malignant tumours in the brain.

Contact Person: Paul Johns