

Past Physics Seminar Calendar: 1995-1996

Viktor Zacek (U Montreal) : Status of Searches for Dark Matter

Monday, September 11, 1995

Location: HP 4351

Time: 3:30 pm

Results from the first round of Dark Matter searches restrict the types and masses of possible candidates but leave room for an interpretation of Cold Dark Matter in terms of weakly interacting massive particles with masses larger than 20 GeV. The detection reaction for CDM candidates is elastic scattering off a detector nucleus and relies entirely on the observation of the small (< 50 keV) ionizing signal of the recoiling nucleus. We propose a new approach for CDM detection with the potential of a substantially improved sensitivity. The technique is based on the metastability of moderately superheated liquids, as used for neutron detection in superheated drop detectors. This type of detector is exclusively sensitive to the high ionisation density of recoiling nuclei, but insensitive to alpha, beta, and gamma radiation. A pilot experiment has been set up at the U de M with the aim to study efficiencies, threshold and intrinsic backgrounds. First results on acoustic event detection and localization are reported.

Contact Person: Dean Karlen

Hans-Dieter Reidenbach (Cologne) : The First Experimental Results on High-Frequency Interstitial Thermotherapy

Monday, September 18, 1995

Location: HP 4351

Time: 3:30 pm

Abstract not received. Contact Person: Bog Jarosz

Francois Corriveau (McGill U) : Recent Deep Inelastic Scattering Results from ZEUS

Monday, September 25, 1995

Location: HP 4351

Time: 3:30 pm

The HERA accelerator provides electron-proton collisions and the means to investigate the structure of hadronic matter at very small distances in a much extended kinematical regime of the x and Q^{*2} variables. Since the initial test run of 1992, data samples of 1 and 6 inverse-pb have been accumulated in 1993 and 1994, yielding new information on the F2 structure function and the gluon content density of the proton. A review of the results from the ZEUS experiment will be presented, with a special emphasis on the most recent analyses, including the diffractive events, the jet properties and the extraction of the strong coupling constant.

Contact Person: Dean Karlen

OCIP Seminar: Sajeev John (U Toronto) : Localization of Light

Monday, October 2, 1995

Location: HP 4351

Time: 3:30 pm

The search for photon localization in dielectric nanostructures has deepened our understanding of coherent wave transport in multiple scattering media. It has applications ranging from optical coherence tomography for diagnostic medical imaging to the development of low threshold microlasers for optoelectronic devices. I review the development of this field starting from the early experiments on coherent backscattering of light to the prediction and fabrication of photonic band gap materials. From the standpoint of quantum electrodynamics, these materials constitute a new class of dielectrics in which spontaneous emission of light from atoms can be inhibited, while at the same time certain propagative effects preserved. I review some of our theoretical predictions for macroscopic quantum coherence phenomena involving photons and atoms in a photonic bandgap.

Contact Person: Dean Karlen

David Charlton (Birmingham/CERN) : Recent Results of Electroweak Measurements with Heavy Flavours

Monday, October 16, 1995

Location: HP 4351

Time: 3:30 pm

Measurements of Z decays to heavy quarks will be presented as updated for the summer 1995 conferences. Improved measurements have been made of the partial decay widths, R_b and R_c , of the Z to b and c quarks relative to the total hadronic Z width, and of the forward-backward asymmetries. The combination of the results from the different LEP experiments and SLD will be described. The experimental measurements of R_b and R_c are discussed in some detail, in the light of the differences seen between the central measured values and the Standard Model predictions.

Contact Person: Dean Karlen

David Hanna (McGill U) : Ground Based Gamma Ray Astronomy * Note Unusual Day *****

Tuesday, October 24, 1995

Location: HP 4351

Time: 3:30 pm

High energy gamma rays arriving from astrophysical sources cause showers of electrons and positrons when they strike the upper atmosphere. These particles travel at relativistic velocities and thus give rise to Cerenkov radiation that can be detected using special telescopes on the earth's surface. Recent progress with this technique has resulted in the observation, at TeV energies, of the supernova remnants M1 (the Crab Nebula) and PSR 1706-44 as well as the BL-Lac object Markarian 421. Meanwhile, the new space-based gamma ray detector, EGRET, has identified a host of similar and often brighter objects at GeV energies but most are not seen by present generation ground-based detectors.

It is now time to build a large ground based telescope with an energy threshold low enough to overlap with EGRET data and determine the cause of the spectral cutoff. This talk will review the current situation in ground based gamma ray astronomy and describe the efforts currently under way to adapt the central receiver solar plant, Solar-1 in Barstow, California, to the task of detecting 10 GeV gamma rays.

Contact Person: Dean Karlen

Archana Sharma (INFN/CERN) : Study and Optimization of the tracking detector for the FINUDA Experiment at Daphne * Note Unusual Day and Location *****

Thursday, November 2, 1995

Location: HP 3269

Time: 3:30 pm

At the high luminosity phi factory, Daphne, the experiment FINUDA aims at a high performance tracking device for hypernuclear spectroscopy. The study and optimization of this tracking system is described with relevance to reducing the predominant multiple scattering contribution to momentum resolution at low momenta. Low mass helium and neon based gas mixtures have been identified and their transport parameters namely drift velocity, diffusion and Lorentz angles are computed. Options of using a TPC or drift chamber layers are evaluated in terms of their spatial resolutions and mass contributions. The chosen low mass drift chamber option is studied in detail. Optimization of the mechanical positioning tolerances in terms of relative variations of spatial accuracies is discussed. Finally the construction and performance of a full size prototype is presented.

Contact Person: Madhu Dixit

Robert Kiefl (TRIUMF/UBC) : Nesbitt Lecture : The Life and Times of an Elementary Particle

Friday, November 10, 1995

Location: Tory 261

Time: 2:30 pm

Contact Person: Peter Watson

OCIP Graduate Student Seminar Day

Friday, November 17, 1995

Location: Senate Chambers

Time: 1-4:30 pm

Contact Person: Pat Kalyniak

Gilles Couture (UQAM) : Theories Beyond the Standard Model

Monday, November 20, 1995

Location: HP 4351

Time: 3:30 pm

I will first describe a few extensions of the Standard Model such as Multi-Higgs-Doublet Models, Left-Right Symmetric Models, and Supersymmetry. Then, we will see how current and future colliders can search for signatures from these models and constrain them. This can be done, for example through anomalous gauge couplings, different asymmetries, and of course new particles. Finally, we will see how these extensions can affect lower energy processes such as rare decays and electroweak moments.

Contact Person: Dean Karlen

Paul M. Meaney (Dartmouth College) : Development of a 2-D Microwave Imaging System for Biomedical Applications

Monday, November 27, 1995

Location: HP 4351

Time: 3:30 pm

A prototype microwave imaging system has been developed to reconstruct 2-D cross-sectional images of the tissue electrical properties within a defined target region. The system employs several algorithms which facilitate the image formation. In conjunction with the numerical algorithm development, a prototype, 4 transmit/ 4 receive channel, 300 to 1100 MHz coherent measurement system was developed having a 115 dB dynamic range with the antennas radiating into a saline bath surrounding the target region. By mechanically moving the transmit and receive antennas to prescribed locations, full measurement data sets were collected and images reconstructed of the material properties of multiple phantoms in order to demonstrate the overall system capability. Images were also reconstructed in a symmetric, reduced data set configuration to achieve dynamic images of a temperature varying object in the center of the target region. Imaging of the changes in tissue electrical properties during heating has potential applications in monitoring temperature distributions during hyperthermia treatment for cancer.

Presently the system is being upgraded to 16 transmit/receive channels such that dynamic images will be achievable for asymmetric phantoms. Work is also being done to design a more clinically suitable illumination chamber that will eliminate the need for the antenna array being submerged in saline.

Contact Person: Bog Jarosz

Cliff Hargrove (CRPP) : A Lead Astronomical Neutrino Detector: LAND

Monday, January 15, 1996

Location: HP 4351

Time: 3:30 pm

In this talk we describe briefly the supernova (SN) explosion mechanism, its neutrino emission and its frequency. With this as background, we discuss the use of Pb as a SN detector. We show that the cross section for neutrino interactions with lead, producing neutrons, is very high. The construction of a detector to measure these neutrinos and its properties is described. The prototype detector is then compared with other SN detectors existing and planned.

Andre Turcot (Chicago) : Beyond the Z: A First Peek

Monday, January 22, 1996

Location: HP 4351

Time: 3:00 pm ***NOTE UNUSUAL TIME***

In November of 1995, the LEP experimental program entered a new phase with the increase of the center-of-mass energy from approximately 90 to 130-140 GeV. The resulting data are the highest energy electron-positron collisions yet observed and offer a first look beyond the Z resonance, a hitherto unexplored energy regime.

In this seminar, the preliminary results from the OPAL experiment for the recent high energy LEP run are presented. Measurements of cross sections and asymmetries are summarized and compared with their Standard Model expectations. Studies of multihadronic event properties are reported on and the results of searches for rare processes and new particles are also presented. The recent and future energy upgrades of the LEP machine are briefly described.

Contact Person: Dean Karlen

Peter Lepage (Cornell) : The Fall and Rise of Lattice QCD

Monday, January 29, 1996

Location: HP 4351

Time: 3:30 pm

It has become clear in the last several months that accurate simulations of nonperturbative QCD are possible using space-time lattices with very large lattice spacings. With the new techniques that make this possible, simulations are 1000 to 1000000 times faster than with conventional methods. This talk describes what has changed, and the widespread implications of these changes for nonperturbative QCD and strong interaction phenomenology. The presentation will be at a nontechnical level!

Contact Person: Dean Karlen

Ervin B. Podgorsak (Montreal General Hospital) : Radiotherapy - State of the Art

Monday, February 5, 1996

Location: HP 4351

Time: 3:30 pm

The basic physical principles involved in radiotherapy physics will be discussed and the equipment used for radiotherapy will be introduced. Standard techniques used in radiotherapy will be explained and the recent developments in radiotherapy described. Also discussed will be some professional issues involving medical physicists such as national and international medical physics organizations and the role of medical physicists in the health care environment.

Contact Person: Bog Jarosz

OCIP seminar: Edward Sloot (Canadian Space Agency) : Microgravity Sciences Program

Monday, February 12, 1996

Location: HP 4351

Time: 3:30 pm

The microgravity environment provides unique conditions for observing physical and chemical phenomena which are difficult, if not impossible, to observe in our terrestrial laboratories. This presentation will provide some experimental highlights and the physics which is embodied in the development of many microgravity payloads.

Contact Person: Dean Karlen

Joseph McKeown (AECL Accelerators) : Uses of Accelerators - A Physicist's Journey

Monday, February 26, 1996

Location: HP 4351

Time: 3:30 pm

Particle accelerators have often been at the forefront of research in physics. Accelerator technology has also caught the attention of chemists, engineers, and physicians for use in diverse fields in industry and medicine. Long term application in advanced fuel cycles for nuclear power are contrasted with current activities in the sterilization of medical products, the displacement of expensive chemicals in the viscose industry, and the potential for environmental applications. All of these applications will be reviewed in an autobiographical story that describes a journey from the known field of pure research into the unknown field of business.

Contact Person: Dean Karlen

CAP lecture: H.J.T. Smith (Waterloo) : What's the Cure for Chaos?

Monday, March 11, 1996

Location: HP 4351

Time: 3:30 pm

'Tis the nature of Nature to be non-linear. The non-linearity may on occasion give rise to chaos which is known to occur in biological, physical, and mechanical systems to name but a few. Chaos may lead to dangerous conditions such as the occurrence of heart fibrillations. In other situations a modification to a chaotic orbit may be used to solve a problem. For instance, when the spacecraft ISEE-3 was on an erroneous orbit, NASA engineers made the appropriate adjustments to the chaotic trajectory of the spacecraft bringing it to the correct orbit with a minimum of fuel usage.

I will describe the properties that can give rise to chaos, outline some of the tools that are used to detect and quantify it, and discuss some ways in which chaos can be controlled.

Martin Yaffe (Sunnybrook Health Science Centre, Toronto) : Digital Breast Imaging

Thursday, March 14, 1996

Location: HP 4351

Time: 3:30 pm

The availability of high resolution photoelectronic arrays for optical imaging, fast computers and high quality video

display devices has opened opportunities for development of improved imaging systems for medicine. We have been interested in applying these technologies to breast imaging, where the earlier and more accurate detection of breast cancer has the potential of reducing mortality from this disease. In this presentation, research on the development of digital mammography will be described with a focus both on x-ray detectors for high resolution imaging and on quantitative use of information that can be extracted from the digital images.

Contact Person: Paul Johns

Kate Scholberg (Caltech) : Searching for neutrinos from Gravitational Collapse with the MACRO experiment.

Monday, March 18, 1996

Location: HP 4351

Time: 3:30 pm

The MACRO (Monopole, Astrophysics and Cosmic Ray Observatory) experiment at the Gran Sasso Laboratory in Italy is capable of detecting a burst of neutrinos from a stellar gravitational collapse in or nearby our Galaxy. The detection of such a burst could yield information on the mechanisms involved in gravitational collapse and on the properties of neutrinos. This talk will discuss gravitational collapse and the nature of the expected neutrino signal. It will describe experimental techniques for detecting such a neutrino signal, focusing on the capabilities of the MACRO detector. The results of a search for neutrino bursts in MACRO data will be presented.

Contact Person: Dean Karlen

Jayanne English (Queens) : Gas Dynamics and Globular Cluster Formation in Interacting Galaxies

Monday, March 25, 1996

Location: HP 4351

Time: 3:30 pm

Along with theoretical considerations, observational evidence is mounting that some elliptical galaxies form via the interactions and mergers of other galaxies. The globular clusters surrounding elliptical galaxies are among the oldest objects in the universe but they are too numerous to be accounted for by the cluster populations of the coalescing parent galaxies. Hence, for the merger scenario to be correct, globular clusters must form during the interaction of the parent galaxies and then age along with the remnant system. Since stars form out of gas, our kinematic study of ionized and neutral hydrogen in interacting galaxies complements current Hubble Space Telescope searches for recently formed globular clusters in merging galaxies. We find, for example, that the merging galaxy system NCG 3256 contains bright gas complexes and massive fragments which satisfy the minimal requirements of globular cluster birthplaces.

Contact Person: Dean Karlen

Jodi Lamoureux (FNAL) : Photon Production at CDF

Monday, April 1, 1996

Location: HP 4351

Time: 3:30 pm

Photon production has traditionally been used to determine the gluon momentum distribution in the proton ($0.1 < x$). The CDF inclusive photon cross section spans a region of gluon momentum not previously measured directly ($0.008 < x < 0.1$). I will describe the photon analysis and the implications of the result on our understanding of the gluon distribution. Time permitting, I will show the diphoton production spectrum which is relevant to backgrounds for low mass higgs searches at the LHC and the photon+charm cross section which probes the charm distribution in the proton. Finally, we have found the first evidence for double parton scattering.

Contact Person: Mike Doncheski

Bruce Pike (Montreal Neurological Institute) : Functional Magnetic Resonance Imaging of the Brain

Wednesday, April 3, 1996

Location: HP 4351

Time: 3:30pm

Abstract not available.

Contact Person: Bog Jarosz

John Rowlands (Sunnybrook Health Science Centre) : Is amorphous selenium the ideal detector for medical x-ray imaging?

Monday, April 8, 1996

Location: HP 4351

Time: 3:30 pm

The requirements for medical x-ray imaging detectors will be discussed. The advantages of electrostatic solid state detectors based on semiconductors (rather than the universally used phosphor) will be elucidated. Then the rationale and reasons for selection of one semiconductor compared to another will be discussed and the possibly unique match of amorphous selenium to the imaging requirements will be demonstrated.

Contact Person: Paul Johns