Bulletin
of the Rutherford and Appleton Laboratories 6 Oct. 1980 No. 14

The LEP Project

European particle physicists are planning the construction of a Large Electron-Positron storage ring, known as LEP, which will allow intense beams of electrons and positrons to collide head-on at very high energies. Scientists are backing this type of machine as being the most likely to produce further major discoveries in particle physics research. It will provide Europe's scientists with unique conditions for the investigation of the fundamental particles and forces in nature.

Clean Study of Bosons

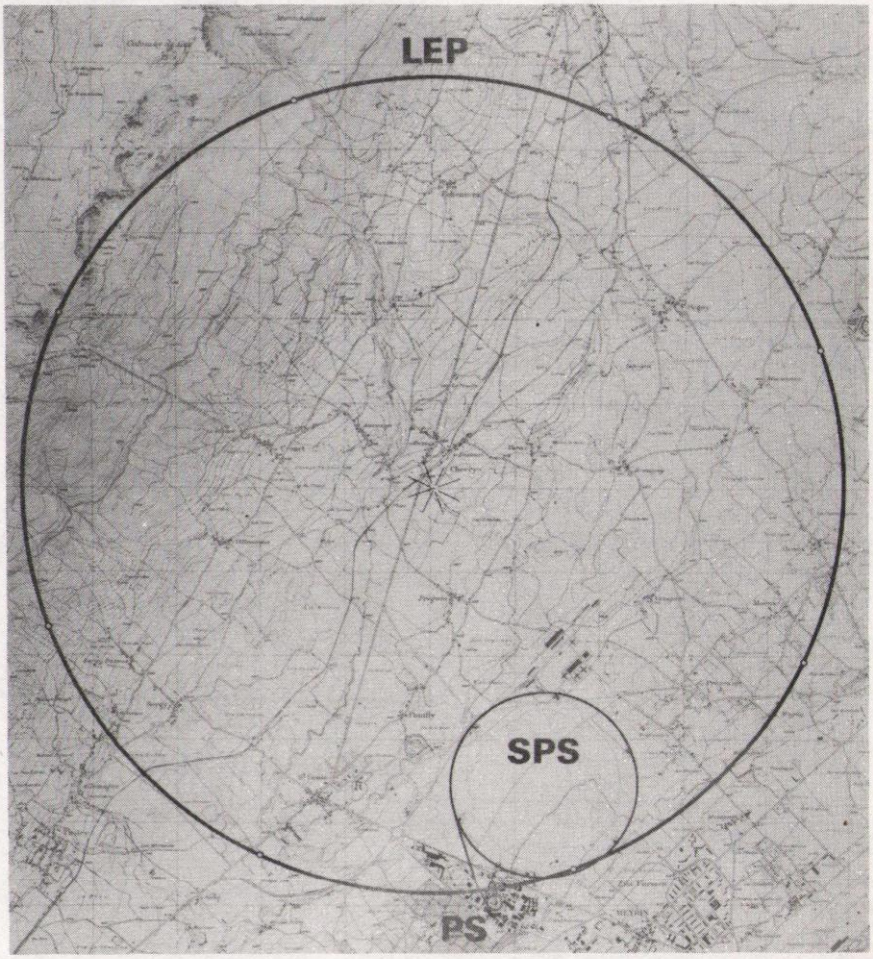
Bulletin No 5 described the conversion of the Super Proton Synchrotron (SPS) machine at CERN into a proton-antiproton collider, which comes into operation in 1981. The new experiments are certain to produce evidence of the carriers of the weak force - the so-called W and Z "bosons" - but the complexity of the collisions may make it rather difficult to perform a detailed study.

However, a high energy electron-positron collider, because of the nature of these particles, will provide cleaner conditions for the production and study of the bosons. The W^+ and W^- are predicted to have masses of 80 GeV and the Z^o about 90 Gev, therefore a collider of 50+50 Gev would be a suitable machine to build in the first instance. Hopefully it will also produce effects which today are quite unexpected!

LEP Design

The design of LEP has been through several iterations over the past few years and has now settled on a ring of 30km circumference which passes under the Jura mountains alongside the CERN Laboratory near Geneva. This site leads to substantial savings since two of the existing accelerators can be used in the injection system.

The injector will involve a 200 MeV electron linac, a converter target for the production of positrons, a positron linac and a 600 MeV accumulator ring. The 600 MeV electrons and positrons will then be injected into the existing Proton Synchrotron (PS) to be accelerated to 3.5 GeV and transferred to the Super Proton Synchrotron (SPS). The particles are then accelerated to 22 GeV in the SPS prior to injection into LEP.



The 30km circumference LEP ring superimposed on a map of the CERN Laboratory near Geneva. The locations of the two existing proton accelerators (PS and SPS) are also shown. (Photo. CEPN)

The LEP ring will be located underground, using the tunnelling techniques mastered in building the SPS to ensure minimum disturbance to the environment.

A total filling time of about 23 minutes is foreseen to achieve about 6×10^{12} particles per beam, refilling every 2 hours to sustain an acceptable luminosity. Injection will be into four bunches of positrons orbiting in one direction and into four bunches of electrons in the opposite direction. The collisions occur in 8 straight sections located around the ring.

The beam lifetime will be about 20 hours with a design pressure of 3×10^{-9} torr in the main ring vacuum chamber. The aluminium vacuum chamber is specially designed to cope with beam losses due to synchrotron radiation which are about 1 kilowatt

LEP continued.

per metre in the first phase. The LEP ring is large to keep down these losses due to synchrotron radiation which increase as the fourth power of the beam energy and are inversely proportional to the radius.

Radiofrequency cavities are used to accelerate the beams and to make up the energy loss due to synchrotron radiation. (For example, the losses at 86 GeV would be about 25 megawatt). The beams are contained by about 4000 bending magnets and 2,000 focussing and correcting magnets (quadrupoles, sextupoles, etc). The bending magnets need only produce low fields. This has led to a new idea in magnet construction, using laminations embedded in concrete, which produces a large saving in costs.

Timescale & Costs

The LEP project was formally presented at the CERN Council in June. The Council agreed that since the project uses existing CERN accelerators in the injection system, it can be considered as an extension of the CERN facilities. This simplifies the authorisation procedures in a number of Member States. It was agreed that the initial phase of the LEP project should reach an energy of 50 GeV per beam and that four of the experimental halls be equipped for colliding beam physics. The total cost of "Phase 1" is estimated at 900 million Swiss francs and it is hoped to finance construction from within existing CERN budget levels over a period of about eight years, though first colliding beams could be achieved sooner.

It is hoped that authorisation for construction will be obtained by mid-1981 and will have passed through all the necessary governmental approvals by the end of that year. If this is achieved, LEP could begin to take shape at the beginning of 1982.

Library Notice

The following books are missing from the Library, R61:

"Optical Image Formation & Processing" by M Francon

"Introduction to Lasers and Their Application", by D C O Shea

"Quark Confinement and Field Theory", by D R Stump

Proceedings of a conference at the University of Rochester, New York, 14-18 June 1976.

It would be much appreciated if they were returned.

Sales to Employees

Sales of scrap metal/plastics as set out in RLN 12/73 will be made on 10 and 24 October at the scrap compound, rear of R40 from 12.00 - 12.30 hrs.

Young HEP Experimenters

33676

The annual Summer School for Young Experimenters in High Energy Physics was held at Chilton from 8-25 September. This year was the ninth in the series, and the third directed by Dr Brian Duff of University College London. Twenty-five postgraduate students - nearly all of the first-year Ph.D students in experimental particle physics in UK universities - attended the concentrated course of lectures and tutorials. The Course Lecturers included Drs David Bailin, Ken Bowler, Derek Imrie, Peter Landshoff and Prof. Gordon Moorhouse. Drs Dave Atkatz and John Storrow were the Course Tutors. Extra evening seminars were held on pulsed lasers for plasma compression and fusion, the proton lifetime and the UK high energy physics programme.

Following the School Dinner, Dr Duff praised the Lectures and Tutors for the success of the courses and the students for their enthusiastic participation. He thanked Dr Stafford and his staff for their encouragement and support of the School, and presented gifts of chocolate to Mrs Hunt and her staff for their hospitality at Cosenor's House and Mrs Sherwen for her excellent organisation. Dr Duff was heartily thanked for his devotion over the past 3 years which had maintained the high standard of the School.

Professor Nicholas Kemmer delivered the after-dinner talk entitled "Past Looks into the Future". Prof. Kemmer, who recently retired from Edinburgh University, reminisced over his meetings with several of the founders of 20th Century physics. In a talk interspersed with humorous anecdotes and several original photographs, he traced the developments from the classical physics era of J J Thompson, through quantum and wave mechanics to field theory and Lee and Yang's ideas on parity violation. Prof. Kemmer spoke with pride of his association with many eminent scientists over the years - he had been "led into physics by great men, and had had the opportunity to lead in other men".

Special Lecture

This lecture will be given on Tuesday 21 October at 15.00 hrs in the R22 Lecture Theatre.

"THE SRC ULTRA-PRECISION CNC DIAMOND TURNING MACHINE FOR X-RAY LENSES".

by

Professor PA McKeown, Mr W J Wills-Moren and Mr H Modjarrad.

Cranfield Unit for Precision Engineering

Conventional optical production technologies are not well suited for producing aspheric and 'conicoidal' shapes for the new complex optical components required in X-ray astronomy and laser fusion developments etc.

The Cranfield Unit for Precision Engineering, amongst many projects involving the design, prototype manufacture and development of ultra-precision computer numerically controlled machines for manufacturing and scientific analysis applications, has included in its programme machines for the manufacture of high precision metal optics by diamond turning. These currently include the SRC's ultra-precision computer numerically controlled diamond turning and grinding machine for the manufacture of X-ray telescope conicoidal components up to 1.4m diameter and 0.6m axial length. This machine, now under construction at Cranfield, is scheduled to be installed at the Rutherford and Appleton Laboratories in August 1981.

The presentation will cover the principles and techniques of design of this machine which is pushing metal cutting capabilities to a new limit of accuracy. The machine will thus represent an important new technical facility probably in advance of other equipment in the world at the time of its commissioning at Rutherford and Appleton Laboratories in 1981.

INTERNAL Events Chilton

NIMROD LECTURES
R22 Lecture Theatre - 14.00 hrs

6 Oct - Dr C Llewellyn Smith/ Oxford

'Status of Perturbative QCD'

(General review talk - Madison conference)

13 Oct - Dr I G Halliday/IC

Title to be advised

20 Oct - Dr R N Mohapatra/Max Planck Inst.

Title to be advised

ASTROPHYSICS SEMINARS
R61 CONFERENCE ROOM - 1400 hrs

16 Oct - Dr David H Clark/RAL

"Observations of Supernovae - Ancient and Modern"

HEP SEMINARS
R61 CONF RM - 11.00 hrs

7 Oct - Dr O Dumbrajs/Karlsruhe
CONF RM 1

'Form Factors and the Search for Zeros'

8 Oct - Dr T R Taylor/Warsaw

'QCD Jets Beyond Leading Order'

22 Oct - Dr N Nicole/Pittsburg and Edinburgh

'The SU(2) Gauge Instanton Programme'.

SPECIAL LECTURE
LECTURE THEATRE - 15.00 hrs

21 Oct - Prof P A McKeown, Mr W J Wills-Moren and Mr H Modjarrad/Cranfield Unit for Precision Engineering.

RAL LECTURES
LECTURE THEATRE - 15.15 hrs

16 Oct - Prof H H Hopkins, FRS/ Reading

"Optics in Clinical Medicine"

SAFETY FILM SHOW
LECTURE THEATRE
12.30, 13.15 and 14.00 hrs

14 Oct 'AFTER DARK'

With the onset of Winter it is as well to remind ourselves of the increased hazard when driving in the dark. This film emphasises some of the problems associated with night driving.

External Events

THEO. PHYS.SEMINAR
T.P.D. 424.4. AERE - 1400 hrs

7 Oct. Prof W H Young/Univ.of East Anglia.
'Molecular Model of Liquid Alloys: Thermodynamic Properties of Li-Pb.'

14 Oct. Dr A E Hughes/AERE

'Some Basic Experiments on the Oxidation of Metals'.

THEORY GP. SEMINARS.
DARESBURY LAB. - 1400 hrs.

13 Oct. Dr J B Pendry/Daresbury
'Inverse Photoemission'

20 Oct. Prof A Budzanowski/Krakow
'Fragmentation of Complex Projectiles'

NPD COLLOQUIUM
CONF ROOM H8 AERE - 15.30 hrs

9 Oct - Dr R J N Phillips/RAL

"Neutrino Oscillations"

PART PHYS. SEMINARS
BIRMINGHAM - 16.15 hrs

10 Oct - Dr R J Homer & Dr J B Kinson/ Birmingham

"Report on the Toronto and Madison Conferences"

17 Oct - Dr G Gopal/RAL

"Review of S=-1 Baryons from Formation Experiments"

Unclaimed Order

An unnumbered order from Tektronix, 5 x 75 ohms BNC line terminators, is held in R27 Admin Office. Please contact Mrs M Ellis or Mrs S Parker on Ext 6289.

RAL Lectures 1980/81 series

The next lecture in this series will be held on Thursday 16 October at 3.15pm in the MAIN LECTURE THEATRE.

OPTICS IN CLINICAL MEDICINE
by
Professor H H Hopkins FRS
Reading University

The modern era of medical endoscopy dates from the first publication on fibre optics in 1954 (Hopkins and Kapany; Van Heel). A brief history of these developments will be given, together with the new surgical techniques that have emerged. Fibre optic bundles are used for illumination of the interior of the body cavity to be examined and coherent bundles are employed to transmit the image in the case of flexible endoscopes. For rigid endoscopes a new lens-type system was invented (Hopkins, 1962) which gives a greatly increased light transmission and improved image quality. The construction of these instruments will be described and the physical principle underlying the new developments will be explained.

INFO Database System

Doric Computer Systems hope to describe their simple-to-use relational type database system INFO, starting at 10.30 am on 8th October 1980, in the Colloquium, the Atlas Centre R27 (coffee at 10.15). INFO is intended for use by non-programmers on problems of resource management, including equipment loan pools, computer accounts records, personnel records, telephone directories, building accommodation and maintenance records, distribution lists etc. For the purpose of the demonstration INFO will be mounted on a PRIME computer of the Interactive Computing Facility. INFO is written in FORTRAN, versions are available for the IBM 3032, VAX 11/780 and several other types of computer. The main demonstration is expected to last about two hours, but the manufacturer will be here all day to answer questions and perhaps mount INFO on the IBM 3032 if there is enough demand.

Open Seminars

FACILITIES FOR TEXT OUTPUT
ON THE FR80 FILM RECORDER
by
Chris Osland

Oct 13 - 1400hrs - Conf.Rm.1. R1

This talk will describe the various ways of producing text output and in particular will deal with the wide range of facilities provided by the FLIST procedure. Details will be given on how to use these facilities from the Coupled Computer System (including ELECTRIC), from CMS and from the Data Editing System (GEC 4080) Future developments will also be discussed.

DATA ACQUISITION AND CONTROL
OF THE IRAS SATELLITE
by
Alan Buck

Oct 14 - 1430hrs - Conf.Rm.3. R61

Software prepared by the IRAS Real Time Software group for the monitoring and control of the IRAS satellite is described. This includes software to control the 12m Antenna, to command and monitor the satellite during the real time passes, to digitise experiment data and to transfer data to, and received data from, project centres in the USA.

Skills and Skullduggery

On Monday 1st of September in the Rec. Soc's new games room a small audience enjoyed an instructive and entertaining exhibition of table tennis skills, provide by Arthur Chilvers, with Mary and Richard Denbow. Arthur is the current Oxfordshire Champion and in the past has played against World and European Champions. Mary, although only fourteen years old, is already ranked in the Oxfordshire Ladies at both Junior and Senior level and is regarded by many as Oxfordshire's brightest hope for international honours. Richard, one year older than his sister, is almost certain to be ranked Oxford County number one at Junior level and probably in the top ten at Senior level, this season.

The exhibition started with a demonstration by Richard and Arthur of the basic strokes used in modern table tennis. This was followed by a demonstration of great accuracy and consistency as Mary and Richard went through a series of training practice routines. Mary then played an exhibition match against Arthur surprising many of the audience with the power of some of her shots. The final match was between Richard and Arthur. At one stage Arthur played several points using a frying pan as a bat, actually winning more points than he lost with this rather unusual style of play. There was also some skullduggery with serves quickly called by Brian Wyborn, the umpire. Time brought the exhibition to a close when the score was one game all.

Lunchtime Music

Lecture Theatre -12.30 - 15 October

'SKY'

'Sky' burst onto the scene and caught the popular imagination with their performance of Bach's Toccata. This group of five gifted musicians has given a new dimension to the world of rock music.

Herbie Flowers began his career in the RAF Central Band, moving on to playing Tuba in a variety of dixieland jazz bands until he bought an electric bass guitar. Since then he has played on some 500 hit records. These days he is both writing and working as a studio musician and is in great demand in America where his reputation is high.

Kevin Peck's career began as a percussionist at Adelaide Conservatorium of Music from where he proceeded as a self-taught guitarist working at weekends in various local dance bands and pop groups. In England he has done sessional work for many of the top pop singers. Amidst the session work, Kevin was also rehearsing the classical side of things. He has done several classical guitar concerts at Wigmore Hall, as well as chamber music throughout the country.

The percussionist Tristam Fry is considered by many to be the finest in the country. Trained at the Royal Academy of Music, he spent five happy years with the London Philharmonic Orchestra. Simultaneously he became involved in background score for TV and films. He has become increasingly in demand as a session musician in the rock/pop areas and is co-founder of 'Sky'.

Francis Monkman also trained at the Royal Academy of Music on organ and harpsicord, and took up electric guitar while a student there. He started doing session work while still at the Academy and has worked with many of the top recording artists. An extremely original and accomplished composer, one complete side of the 'Sky' album is a Monkman original. He also continues to give classical concerts.

John Williams (guitar) studied with Segovia before undertaking a full musical education at the Accademia Musicale Chigiana in Sienna and the Royal College of Music, making his London debut at the Wigmore Hall in 1958. His musicianship has created an incredibly wide audience covering most musical tastes and as a classical artist he appears all over the UK, as a solo performer, with Julian Bream, and with the country's principal orchestras.

Having worked with and being an admirer of the talents of Herbie, Tristam, Francis and Kevin, 1980 sees John as co-founder of 'Sky' a band that will complement all of their individual careers, and accord them an opportunity of writing, playing and fusing their ideas with the contemporary rock music field.

HortSoc Show 1980

33590

The Annual AERE Horticultural Show was held on 11 and 12 September in the Social Club AERE. The number of entries was less than last year, with unfortunately no-one from the Labs winning any trophies or prizes. Despite the poor summer the quality of the vegetable section was generally good. The flower section was well supported with Les Sedge showing some superb chrysanthemums and dahlias. The floral art section had the largest number of entries for many years, and our President, Mrs Marshall, won the Flora Award for the best entry in that section. Other sections were well represented - except needlecraft in which there were fewer entries. The Show was enjoyed by many staff from Harwell and Rutherford and Appleton, and proved, as usual, to be a great success.

The Society is organising a cheese and wine evening in the Coffee Lounge R22 on Friday 20 November at 8.00pm. If you are interested please contact John Hogston Ext 6692 R2.

Coffee at Cosener's

There will be two coffee mornings at the Cosener's House (Abingdon) this autumn. The first will be on Tuesday October 14th and the other on Tuesday December 9th.
Both mornings will be during the usual times of 10.30 am to 12 noon.

For further information ring Gillian Litt (Ab. 26009) or Dorothy Gibson (Ab. 25250)

Mon. 13 Oct.

Bulletin

Editor: Jean Banford
Building R20
Rutherford and Appleton Laboratories
Chilton, Didcot, Oxon OX11 0QX
Abingdon (0235) 21900 ext 484

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