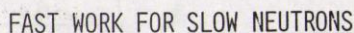




12-26 August 1974

bulletin 16



Most of the experiments which will be carried out on the new instrument will be in the field of magnetism. Neutrons are scattered by the nuclei in solids and, through interaction with the neutron's magnetic moment, also by those electrons which give rise to any magnetism in the solid. If the incident neutron beam is polarised, interference between these two scattering processes can occur and observations can be made which are both a precise and sensitive measure of the magnetisation. The results are frequently illustrated by contoured maps of magnetisation density on the atomic scale and are invaluable in elucidating the ground state wave-functions of the magnetic atoms or in studying the phenomena of covalency.

INTERNAL EVENTS

SPECIAL NIMROD LECTURE

Monday 12 August
11.30
Lecture Theatre

Review of Many-Particle Production Models

Dr A Bassetto/University of Padua

ATLAS LAB COLLOQUIUM

Tuesday 13 August
14.00
Colloquium Room, Atlas Lab

"CHESS 4.0" by David Slate and Larry Atkin

The first world computer chess championship will take place at Stockholm from 5-8 August 1974. Twelve programs have been entered and countries represented include the USA, the USSR, Germany and England. The current favourite is the American "CHESS 4.0" program which has never (as yet) been beaten by another program. The authors, David Slate and Larry Atkin, are visiting the Atlas Laboratory following the competition and have agreed to reveal some of the "secrets" of its success. As well as for chess enthusiasts, this talk should also be of interest to those working on programming techniques for operations research; in particular the searching and pruning of large decision trees.

HEP SEMINARS

all at 11.00
Lecture Theatre

Wednesday 14 August: Title to be announced - Y Oyanagi/NLHEP, Japan.

Monday 19 August: Title to be announced - A Schwimmer/Weizmann Institute.

Wednesday 21 August: Making the Dual Photon Massive: A New kind of Higgs-Schwinger Mechanism? - C Rosenzweig/Weizmann and UC Berkeley.

TRADE DEMONSTRATION

Thursday 15 August
10.30 - 16.00
Conference Room, Building R12

Systems Reliability Ltd are presenting demonstrations of their Logical Signal Processor. This is an advanced form of programmable interface which has been developed to provide solutions to many digital interfacing and control problems. The L.S.P does not have a defined interface, but is provided with groups of data input and output signal lines, which are grouped together to construct the physical interface. The information is then processed in a logical or arithmetical mode through the various logical elements, which are structured into the architecture by the user's program. The rates of flow are also controlled from within L.S.P which has the impressive operation obey time of 150 nanoseconds.

NIMROD SCHEDULE

CYCLE 6 30.7.74 - 20.8.74

MACHINE PHYSICS

HIGH ENERGY PHYSICS

<u>Team</u>	<u>Beam</u>	<u>Experiment</u>	<u>State</u>
CERN/ORSAY/OXFORD	P81	Hadron-Proton Spin	Data
RUTHERFORD LABORATORY	$\pi 11$	Beam Measurements	Tests
IMPERIAL COLLEGE/RL	$\pi 8A$	Experiments on Narrow Bosons X^0 (958) S* and Cross-Section Measurements	Data
BEAM DETECTOR GROUP	K15A	Parasitic Running	Tests
COUNTER GROUP B/ CAMBRIDGE UNIVERSITY	$\pi 12$	$\pi^- p \rightarrow K^0 \Lambda^0$ in the Range 1.4 - 2.0 GeV/c	Setting up
RUTHERFORD LABORATORY	$\pi 9$	Polarisation in $\pi^- p \rightarrow \pi^0 n$, nn	Setting up
BIRMINGHAM/SURREY/RL	K17	Stopping Kaons	Data

FILM BADGE NOTICE

The next film issue commences Monday 12 August. Colour Strip - PURPLE for $\beta\gamma$ films and neutron

packs.

Please note that due to the paper shortage there are no envelopes available for return of dosimeters. Please therefore return used badges either by placing in the boxes beneath the film boards or in your envelope marked with the senders name and building number and addressed to Film Service, Building R2.

Six monthly TLD change for people with surnames commencing G. H. I and J.

TELEPHONE EXTENSIONS

As the Editor suffered recently it may avoid similar suffering by others if they amend their

directory, page 11 to read - Cambridge/RL ($\pi 12$ Beam) Control Room, R6 Ext. 6343.

OPPORTUNITY FOR FELLOWS AT CERN 1974-5

Information about the CERN FELLOWSHIP PROGRAMME can be seen on request at Room 68,

Personnel Group, Building R20.

In this, the second part of the Conference report, Bill Toner discusses the implications of the surprising results from CEA and SPEAR and Gordon Walker reviews the exciting new results from FNAL on total cross-sections.

The results of the first deep inelastic electron scattering experiments presented at the 1968 conference in Vienna showed a cross-section which depended on the ratio of the momentum transfer to the energy transfer rather than on those two variables separately and which was much larger than anticipated. Extrapolations of these data agree to within the experimental uncertainties with results presented at this year's conference from electron and muon scattering experiments at energies up to 150 GeV and momentum transfers up to 50 (GeV/c)², where the cross-sections are $\sim 10^3$ times greater than the pre-1968 expectations. The details are in quite remarkable accord with the simple quark parton model in which the nucleon is imagined to be made up of point-like constituents with the quantum numbers of the quarks which explain the spectrum of the strongly interacting particles. For example, from the difference between the scattering from neutrons and protons a sum rule giving the difference in the sum of the squares of the parton charges can be derived. In the model this is $5/9$ for the proton minus $6/9$ from the neutron = $3/9$ for the difference, in agreement with results presented at the conference. More remarkable still, the model allows one to predict correctly the behaviour of the inelastic neutrino and anti neutrino cross-sections, and the π^0/π^- ratio in the secondary particles produced in these reactions, as was discussed by Wilbur Venus in a previous newsletter.

Scaling and its interpretation in terms of the parton model is in excellent shape - until one turns from the space-like region of inelastic scattering experiments to the time-like region of electron positron annihilation into hadrons. In one of the best attended sessions of the conference, Richter described the surprising results from CEA and SPEAR which show that this cross-section, though orders of magnitude greater than would have been expected before 1968, fails to conform with the parton model predictions: the hadronic annihilation cross section is roughly constant and does not decrease like (energy)⁻².

Detailed and precise checks of reactions where no strongly interacting particles are produced show that Quantum Electrodynamics is not at fault.

It has been known for some time that, contrary to expectation, the pp total cross-section (i.e. interaction probability) rises from CERN/Serpukhov energy ranges up to ISR energies). New data from FNAL shows clearly that the total cross-sections σ_{TOT} of the strongly interacting particles, π^+ , π^- , K^+ , K^- and n also rises. The sole exception is the antiproton proton total cross-section which continues to decrease. The measurements demonstrate beyond doubt that rising total cross-sections are a general high energy phenomenon. The fact that the K^+ cross-section demonstrates this effect at the lowest energy is probably related to the fact that its total cross-section is the smallest. This suggests that the rising component is present at all energies but can reveal itself when the particle exchange type terms have become sufficiently small. The analytical behaviour of the rising component is however still unknown. Further information from sources other than total cross-sections will be needed.

A comparison of the energy dependence of the various total cross-sections suggests that at high energies all strongly interacting particles behave according to their fundamental constituents. The present evidence is consistent with the predictions of quark constituents.

Further data was presented from ISR, NAL, Serpukhov and CPS on elastic scattering. Briefly the elastic data

Results from SPEAR in particular show that any deviation from the point like structure of the basic interaction between leptons and photons, whether space-like or time-like, must be on a scale less than 6×10^{-16} cms.

The SPEAR experiment on hadronic annihilation is the first to incorporate a magnetic field so that there were many new results on the composition and spectrum of the particles which are produced. The main features are as follows: (i) the angular distribution is close to isotropic, with no sign of jets; (ii) particles with less than half the maximum possible energy are distributed roughly according to phase space, with $E \frac{d^2\sigma}{d^3p} \sim \exp(-E/kT)$ with $kT \sim 168$ Mev, regardless of whether pions, kaons or anti-protons are being produced. There are striking similarities with particle production at 90° in p-p reactions at FNAL and the ISR; (iii) particles with more than half the maximum possible energy seem to show the kind of scaling suggested by the parton model.

There were twelve times as many theoretical contributions as experimental on the topic of e^+e^- annihilation into hadrons. None were able to explain the data. The parton model describes part of the momentum spectrum, but fails on the cross-section and angular distribution. Thermodynamic models describe part of the momentum spectrum and the angular distribution but have nothing to say about the cross-section. Those bold enough to predict distributions on the basis of models which fit the cross-sections were rapidly hit on the head with contradictory data. Some models were forced to retreat to higher energies by other experiments. For example, in the Pati Salam model where the leptons are incorporated as quarks - so that strong, weak and electromagnetic reactions are unified simple fits to the SPEAR data require differences between e^+ and e^- scattering, and none have been seen despite a search for them at SLAC.

Next year, SPEAR should reach 4 GeV per beam and we may learn whether this behaviour is with us to stay, or merely transitory. Proponents of e^+e^- machines at still higher energies - such as EPIC at 14 GeV per beam - have even more reason than before to be enthusiastic about the richness of the physics in these reactions.

presented extends our information in energy or momentum transfer but no new unexpected features were revealed.

The present data on total cross-sections and the slope of the diffraction pattern of elastic scattering reactions leads to the following optical model picture of a high energy collision. The two particles are still partially 'transparent' to one another, i.e. they do not behave like totally absorbing 'black discs'. The increase in cross-section occurs without much change in 'opacity' and is mainly achieved by a small increase in the radius.

A series of experiments at FNAL (Fermi-Lab) have shown apparently that electrons and muons (collectively called leptons) can be produced directly in high energy collisions. Leptons are observed in large numbers from the decay of the strongly interacting particles produced by high energy collisions. The experiments show an excess over those produced from decay process. If the excess is confirmed as being due to direct lepton production from a strong interaction then it would demonstrate that at high enough energies the leptons can indeed be influenced by the strong force. This could lead the way to the exciting possibility of the unification of the strong and electromagnetic forces - a possibility already being discussed by several theorists (e.g. Pati and Salam). More experimental and theoretical work can be expected on this subject in the near future.

RUTHERFORD LABORATORY BULLETIN

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Editor: H F NORRIS

Deadline
for
Insertions

GENERAL & SOCIAL NEWS

INTERNAL & EXTERNAL EVENTS

Room 42 Building R20
Rutherford Laboratory
Chilton Didcot Berks

Tuesday 1600

Wednesday 1200

Abingdon 1900 Ext 484

OVERSEAS VISITS

Dr D R Quarrie, I M Bloodworth and G M McPherson to Norway, 11-24 August, to attend CERN School of

Computer at Goddysund.

P Seager, to CERN, 16 August-2 September for discussions.

T A Broome and B T Payne, to CERN, 19-23 August, for discussions.

Dr J R J Bennett, to the USA, mid August to mid December to assist in commissioning of uprated SPEAR storage ring project.

Dr S Read and Dr S Cox, to Belgium, 25 August - 7 September to attend "International Advanced Study Institute" at Leuven.

P J Hemmings, to Switzerland, 25 August - 16 September, to liaise and advise 195 users at CERN, and to attend SEAS anniversary meeting at Zurich.

MISSING EQUIPMENT

A $\frac{3}{8}$ " Wolf Sapphire 2 speed Electric Drill, Ser. No. 1127A, RL No. 14/5265 is missing from the R8

Electrical Workshop. Anyone with information on the present whereabouts of this drill is asked to contact E T Gourley, R8, Ext 6647.

FOUND

A sum of money has been found in Building R1. Claimants please contact P B Nichols, Rm. 2.76, R1.

SOCIAL NEWS



SEAFARING MAN RETIRES

In the photograph above, George Owens is shown holding a model of a van (and its painted yellow!). The occasion was the retirement of George after 7 years service. Roy Tolcher, Head of the Mechanical & Electrical Services Section, in presenting George with an envelope (the proceeds of a considerable collection) and a small parcel containing the model van, spoke highly of his friendly attitude and great willingness to undertake any task.

George has had an interesting life having served in the Merchant Navy for 30 years, first as an A.B and later as a bo'suns mate on the Ile de France, (which during the last war was an armed merchant cruiser and the Queen Mary. He was at Dunkirk and was torpedoed three times in the Atlantic). As a result of 3 general cargo boats being sunk under him George spent 3, 5 and 2 days adrift in small boats. Did he see any subs sunk - 'well - when fired on they disappeared quickly!' After all, the Ile de France did amongst its armament, carry a 6" gun aft! After 30 years afloat George became a land lubber

spending 7 years on security work for GEC in Kent. He moved to Didcot for the benefit of his wife's health.

George said he was very sorry to be leaving but he had plenty to occupy his time; a large garden and a lot of decorating both inside and outside his bungalow and above all the intention to enjoy himself and look after his wife. Many people will not know his name but they will recognise the face in the photograph as the driver of the Electrical Services (yellow) van, as the man who came and changed their light bulb or tube, as the man who was always pleasant and helpful.

George, we all wish you a very long and happy retirement, you deserve it.

CHRISTIAN FELLOWSHIP

August 16. All are welcome to join in a time of fellowship led by Meyrick Wyard of Bldg. R18, at 12.30 in the Conference Room, Building R12.

August 23. The land of Israel is often, if not always, in the news. Ken Potter will be showing some slides of a holiday which he had there some time ago and all are welcome to come and see them. The 'showing' commences at 12.30 in the R12 Conference Room.

HORTICULTURAL SOCIETY SHOW

The 32nd Show will be held in the marquees (opposite the AERE shopping centre) on the 19 and 20 September 1974.

Regulations and schedules are now available from all Committee members on request. There are 22 flower classes, 20 for vegetables, 6 for fruit and 6 for floral art. Preserves have 5 classes, cookery 8, needlecraft/handicraft 9 and wine making 5. There are a large number of prizes and awards (Bowls, cups, tankards, trays etc) to be won including the Banksian Medal presented by the Royal Horticultural Society. More information later.

ANOTHER FAREWELL

Bob Hilborne (the joking Irishman?) left R20 last week to take up an appointment in the SRC, London

office. As he did not have time to see all his friends before he left he wishes to say cheerio through the Bulletin. Bob, R20 will miss you, and your seemingly endless fund of jokes.